MAY
JUNE 1958

Metal Treating

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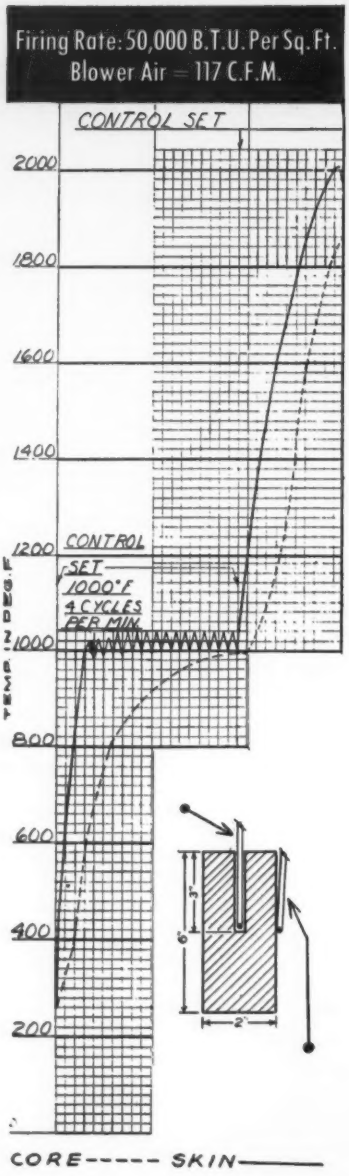
THE *ONLY* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

Continuous-type electrode salt bath furnaces for controlled distortion work. (See page 2).

INSTANTANEOUS HEAT with Holden Combustion System

INSPECT THIS PROVEN OPERATION AT OUR DETROIT PLANT



TEST DATA

1. A 20-gage thermocouple was welded to the outside of the 2" diameter x 6" long piece. A hole was drilled to accommodate a 20-gage thermocouple to record the inner temperature and the time differential.

2. The heating condition with the Luminous Wall face firing rate at 50,000 BTU's per sq. ft. in the following temperature ranges:

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EDITORIAL

Aspirin Won't Cure Heat Treating Headaches

Industry and Defense today constantly make more severe demands on metals — requiring greater strength, lightness, endurance, toughness, resistance to corrosion and to heat. Better workability, easier forming, machining, drawing, finer accuracy of size and shape are becoming mandatory.

The specialized knowledge needed in this field is the province of the Metallurgist. To be effective he must have a thorough technical training in a highly complex and rapidly growing science, plus a working familiarity with many associated branches of engineering and production.

Heat Treatment is the metallurgical process which creates amazing improvements in the properties of metals by heating and cooling them in certain controlled ways.

The purchase and installation of heat treating equipment does not make one a heat treater, any more than acquiring a set of surgical instruments could qualify the owner to perform surgical operations. Furnaces and pyrometers cannot solve the numberless problems that arise daily in the practice of this complex art.

That is why a new industry is growing in this country, namely the Commercial Heat Treatment of Metals. These organizations not only provide the necessary plant facilities, but also even more important, the technical training and know-how that are derived only by long years of intensive study and practical experience.

Without this knowledge, heat treating is a "headache". There are no pills to cure it.

The competent Commercial Heat Treater serves you as would any professional specialist. Select one you can depend upon and profit by his help.

HORACE C. KNERR
Chairman, Publication Committee

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THE USE OF ELECTRICITY IN HEAT TREATING OPERATIONS AT CHRYSLER

By **ROBERT E. MORKEN,** Consultant
Heat Treating Methods and Equipment
Chrysler Corporation,
Detroit, Michigan

Editor's Note: *The author has also written a sequel to this article entitled "The Use of Gas in Heat Treating Operations at Chrysler" which will appear in the July-August issue.*

THE CHOICE between electrically-heated equipment and gas-fired equipment is usually determined by economic factors in a given location. In some areas the cost of electricity is such that it becomes the normal choice for heating requirements. In other locations, electricity is prohibitively expensive for normal operations and gas becomes the favored fuel. Most of our plants are located in areas in which the latter is more or less the rule, and we have determined that it costs approximately 3 times as much to power heat treating furnaces electrically as it does to heat them with natural gas. Hence, we normally specify gas-fired furnace equipment, all other factors being equal. This choice covers most of our annealing, carburizing, and hardening furnace equipment. However, certain electrically-heated applications are preferred for reasons other than basic differences in power and gas rates; in other words, we find we can do certain things with electrically-heated equipment that would be more difficult or more costly to accomplish by other means.

Fig. 1—Batch-type salt bath furnace.

Batch-type Furnaces

Let us consider first the heat treating equipment required in our laboratories and tool rooms. Furnaces for these purposes are almost invariably batch type furnaces and fall within approximately the same physical dimensions. Also, the way in which tool room and laboratory furnaces are used make them applicable for the same comments. Let me assure you that we have a decided preference for electric heat in this type of equipment. The use of electricity in this case provides for considerably greater temperature ranges in a single piece of furnace equipment than we could reasonably obtain with gas firing. We have such furnaces that can be operated within decent temperature variation tolerances from 350°F to 2400°F. This is very difficult to accomplish with gas heating. Furthermore, this type of furnace is usually operated on a periodic basis. It may be used this morning, and not again until 48 hours later, or it may be used on first shift only. Hence, it is economical to cool off the furnace between jobs. We find it is much easier and far safer to do this with electrically heated furnaces. In other words, we tend to prefer electric furnaces for jobs that are not continuously operated. They require no special skill or attention in starting up or shutting down. They can be powered to come up to heat quickly and yet have the versatility of wide temperature ranges. In addition, electric furnaces of this type can be built to attain a far higher temperature than can economically be attained by gas firing. Here then is one of the ideal applications for electric furnaces.

Salt Bath Furnaces

We use a considerable number of salt bath furnaces. When I first came into the metal treating industry, these furnaces were all gas fired and used a highly alloyed and very expensive cast pot to contain the molten salt. Premature pot failure, especially with the neutral chloride base salts, was the rule. Every time a pot failed prematurely the furnace combustion chamber lining became saturated with molten salt. A pot failure, therefore, necessitated a complete rebricking of the combustion chamber as well as replacement of the expensive alloy pot. This condition had

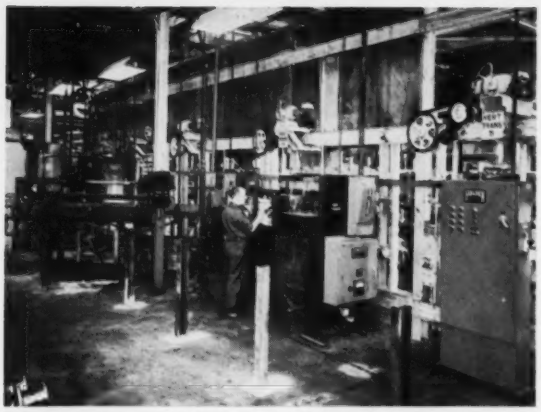


Fig. 2—Continuous-type electrode salt bath furnaces for controlled distortion work.

become almost intolerable when the electrode salt bath furnace was introduced. We have converted our salt bath equipment to the electrode type with but few exceptions, and have saved many thousands of dollars in so doing. I believe the first electrode salt bath installation we made was in the tool room where we purchased equipment to harden high speed steel. The high speed steel had formerly been hardened in semi-muffle type furnaces at temperatures in the range of 2200°F to 2325°F. We had a terrible time fighting decarburization in this equipment, especially with the molybdenum high speed steels then gaining favor. The electrode salt bath furnaces immediately solved the decarb problem and have been operating efficiently and economically ever since.

Later we began replacing our gas-fired salt pots with the electrode type for maintenance reasons. In so doing we found that we had alleviated a bad ventilation problem as well. It is much less costly to ventilate electric furnaces than it is to ventilate gas-fired furnaces. Sometimes this may be the determining factor in the selection of equipment. In fact, in our new Kokomo Casting Plant, ventilation is such a cumbersome and costly problem that principally for that reason electric furnaces are being installed at the die casting machines.

Continuing with salt baths, another use for which we find the electrode salt bath admirably suited is in controlled distortion work. This type of equipment is extremely adaptable for austempering and martempering. With the increased necessity for more and more precision parts required in today's products, it is a safe prediction that the electrode salt bath will become increasingly important in our heat treat planning. This type of equipment lends itself well to automation and can readily be located in machine-line sequences. Such a location is advantageous, of course, because it saves in material handling costs.

Since cost reduction is one of our ever-present problems in today's highly competitive market, we must do everything possible to minimize distortion during heat treating operations. Distortion is costly and necessitates expensive straightening operations. Therefore, we are thinking more and more in terms of austempering and martempering close tolerance precision parts. Both these processes require quenching baths to be operated at elevated temperatures in the range of 350°F to 1100°F. The electrode salt bath furnace fits these requirements to our satisfaction, and we are today using this type of equipment to austemper and martemper certain critical parts on a production line basis with a high degree of success. In fact, the result is a freedom from distortion, and attainment of physical properties unattainable by any other known method.

Sintering and Brazing

There is another metal treating problem for which we have found electric furnaces to be the best adapted to the job requirements. This is in the high temperature field of sintering and copper brazing. Let us consider both these applications in the category for the moment because of their similar high temperature requirements. We are now talking about temperatures in the range of 1800°F to 2100°F, with a few requirements going on up to as high as 2600°F. In all cases, highly reducing atmospheres are required within the furnace chambers and therefore, we must think in terms of furnace construction that is sealed to the atmosphere. This can be accomplished in gas-fired equipment by the use of direct fired muffles, or by use of radiant tubes. It is easily accomplished in electric furnaces by the use of either nickel-chrome alloy ribbon heating elements, or bonded silicon carbide rod type elements. Several attempts have been made to construct gas-fired equipment of both muffle and radiant tube design to fulfill the requirements of such high temperature atmosphere work. We must await the development of alloys capable of withstanding such high temperatures for longer periods of time before it will be economically feasible to specify

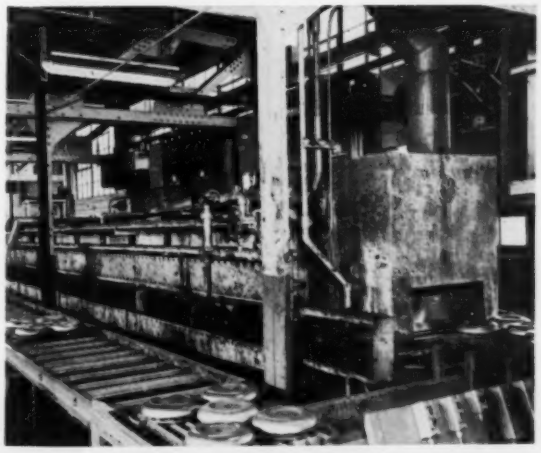


Fig. 3—Copper brazing furnace for torque converters.

gas-fired furnaces for these applications. Hence, our best answer today lies in the use of electric furnaces. Lately, however, we have begun to use increasing numbers of the silicon carbide-type elements. We tend to prefer the latter because of the ease in changing elements, and the minimum of down time that such ease of changing permits. By properly zoning such furnace equipment, very uniform temperature control can be attained, and this is a definite advantage in the type of work usually run in these furnaces.

As an example, let us examine torque converter brazing. In this particular job we are copper brazing blades of 0.030" thickness to torus rings of 0.060" and shrouds of 0.120" all in the same assembly. To furnish the source of copper we use highly refined cuprous oxide carried in suspension in a specially compounded hydro-carbon vehicle. This cuprous oxide is sprayed automatically on the parts to be joined by copper brazing. The sprayed assemblies are then inverted on supporting fixtures resting on fabricated trays which are charged automatically into the brazing furnaces. Now, with metal sections of three different gauges entering the furnace at the same time, a very unequal expansion is going to occur. Hence, the rate of heating is extremely important and must be accurately controlled. I know of no better way to do this than by the use of large numbers of heating elements so connected as to provide for great flexibility in power input. Then, too, we have found that the cuprous oxide must be substantially reduced to metallic copper before a temperature is attained sufficient to melt copper. If the melting point of copper is reached while quantities of unreduced oxide remain, the molten copper absorbs the remaining oxide. Once the oxide is absorbed into the molten copper it is next to impossible to accomplish further reduction. The net result is a very sharp decrease in joint strength. Therefore, throughout this particular brazing operation, we must maintain closely-controlled time and temperature relationships. This we have been able to do with a high degree of success in an installation of four silicon carbide element furnaces comprising a connected load of 1800 kilowatts. The largest of these furnaces is constructed in four zones of control using eight pyrometers to control input to twenty-six individually adjustable circuits.

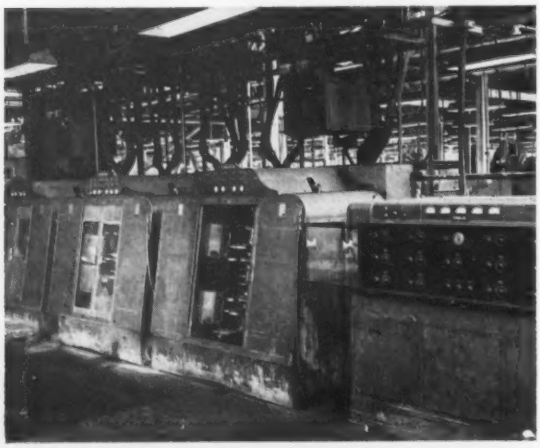


Fig. 4—Induction hardening equipment for crankshafts.

In our sintering work we have begun to take advantage of the lower unit costs of gas, however, and our more recent installations provide for a gas-fired radiant tube preheat chamber ahead of the electrically heated high temperature chamber. A number of economies are involved in this type of construction, and the marriage of the two rivals seems to be quite compatible.

Atmosphere Problems

I mentioned briefly that we were working in this field with temperatures as high as 2600°F. This work also requires reducing atmospheres, and furnace construction for these requirements poses some inordinately complex problems. A certain degree of success has been achieved through the use of full muffle furnace construction utilizing molybdenum elements exterior to the muffle. Since molybdenum oxidizes readily at the temperatures necessary for this work, it is necessary to protect the elements from air. In certain applications the atmosphere used to protect the elements is not compatible with the atmosphere required inside the muffle, and extensive precautions must be taken to prevent mixing atmospheres. For this reason we have conducted a large amount of research toward designing a better element and it appears as if we are about to attain success. These elements consist of a molybdenum wire element encased and permanently sealed into a refractory tube corresponding in size to the silicon carbide elements with which you are familiar. Such an element has virtually eliminated the atmosphere problem, is easy to change, and can be grouped readily into required zones for close temperature control. A further advantage occurs from the ready adaptability to gas rich or carburizing atmospheres which do not harm this heating element.

There is another place where electric furnace equipment fits very well into our operations. Ours is a rapidly changing industry, and our production facilities are subject to frequent changes and relocations. Hence, we often find ourselves with a heating problem in a location where there is no gas distribution system. Since our electric power distribution systems nearly blanket our plants, the obvious answer lies in the use of electric furnace equipment. We recently encountered a rather unique example of this type of application. It was discovered that a certain amount of rejected parts were being run on highly automated machining operations immediately after changing cutting tools. The tool set ups were checked and rechecked against master gauges until the dimensional

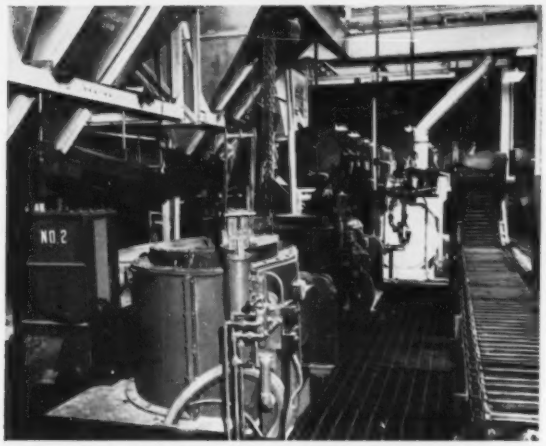


Fig. 5—Induction equipment for aluminum melting.

variations were traced to a difference in temperature between the new tools and those that had been just removed. Now, we don't ordinarily run gas distribution systems throughout our machine shops, so we are placing small electric ovens at such locations to bring cold tools up to the operating temperature of tools cutting metal, thus eliminating rejects from this cause.

Induction Heating

In the early 1940's we entered into an extensive research program directed toward possible applications of induction heating in our operations. A laboratory was appropriated and completely equipped with both low and high frequency power sources. From the beginning of this program we found applications of induction heating that resulted in almost astronomical cost savings, and we are continuing to find such applications even today. We have, in the meantime, learned a lot about induction heating. We now have a reasonably good idea of where it can be economically applied and where it can't be. We've learned, for instance, that the geometry of the piece being heated has a vital bearing on whether or not we can use induction. We've learned not to attempt to apply induction heating for surface hardening as cast or as forged surfaces. The dimensional tolerances involved are so great as to completely upset the closely controlled time-temperature relationship necessary for successful induction hardening. We've learned that induction equipment fits very well into mechanized production lines. The equipment is cool to work around, it is easy to ventilate, it is easy to automate, and it does not occupy much space.

Surface Hardening

Most of our induction jobs fall within the category of surface hardening. It is here that we have found the most economies. In general, heat can be put into steel at a rate of approximately 50 Btu per square inch per minute by furnace heating; at about 150 Btu per square inch per minute by high intensity flame heating; and at from 600 to 900 Btu per square inch per minute by induction heating. I think these input rates illustrate the adaptability of induction heating for surface hardening work. In induction surface hardening work, the heated depth is affected by coil design, the heating cycle time, and the frequency of the power source. Frequencies in cycles per second of induction equipment vary from 60 cycles to 1,000,000 cycles. The effect of frequencies on heat penetration is shown by the following table:

Cycles/Sec	*Theoretical Penetration*	*Practical Penetration*
60 Cycles	2.80 inches	about 3 inches
960 Cycles	0.70 inches	about 1 inch
3,000 Cycles	0.035 inches	about 0.060 inch
9,600 Cycles	0.020 inches	about 0.040 inch
120,000 Cycles	0.006 inches	about 0.030 inch
500,000 Cycles	0.003 inches	about 0.020 inch
1,000,000 Cycles	0.002 inches	about 0.010 inch

Induction heating creates heat in steel principally by means of I^2R losses due to the resistance of the steel to the flow of the electrical energy induced beneath the steel surface. The practical cases obtainable differ from the theoretical because of heat conducted into the steel as it is being heated. Hence, the time of heating has a considerable effect on the final case depth. Most of the equipment sold today for induction hardening is either 9,600 cycle obtained with a motor generator set, or 500,000 cycle obtained with an oscillator tube set. We have found that for the most practical and economical operations we should not attempt to heat to a depth appreciably in excess of 0.060" with oscillator tube equipment. When we attempt to do so, the power input becomes excessive, cycle times increase beyond decent limits, there is great danger of over-heating the steel surfaces resulting in cracks and poor metallurgical properties.

The first installation of induction hardening at Chrysler Corporation was a 9,600 cycle motor generator set tooled to surface harden the bearing journals on crankshafts. That set is still in operation today and was the forerunner of the many installations to follow. Quite logically, because of design geometry, we first concentrated on such symmetrical objects as king pins, water pump shafts, differential pinion shafts, shock absorber piston rods, transmission main shafts, etc. As we accumulated more knowledge, we started to induction harden such things as fly wheel ring gears, water pump drive gears, gearshift forks, gearshift rails, transmission countershaft gears, and many more parts of a rather complex nature. Our more recent installations involve such products as rear axle drive shafts, steering knuckles, connectors for the power steering units, torque converter transmission countershafts, intake and exhaust valve rocker arms and rocker arm shafts. We have made induction hardening installations

(Continued on page 52)

BLAZES!

By **A. S. EVES**
Perfection Tool and Metal Heat Treating Co.,
Chicago, Ill.

IF ONE of these days a couple of local firemen come tapping at your door, by all means let them in. Chances are they won't be trying to sell tickets to a fund-raising ball; instead they'll be visiting you in their spick-and-span uniforms simply because they want to avoid a later call in rubber coats and boots. There's reason enough!

Despite all that has been said on the subject, the nation's annual fire loss has jumped a startling 20% in the past five years. Last year alone our factories suffered 60,000 fires in which the damage totalled $220 millions. Worse yet, 10,000 human beings perished in the flames, while 30,000 more were mutilated in horrible fashion.

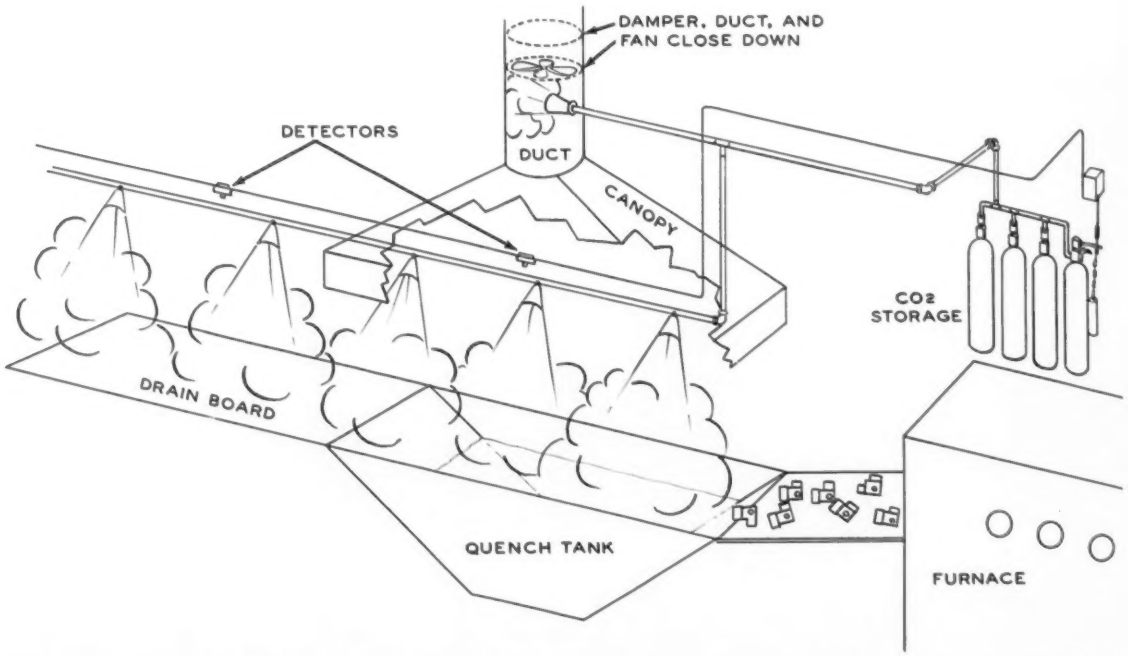
In every hardening room lurks danger of a real conflagration. All of us know one or more heat treat firms that recently went up in smoke. Fire has no respect for the size of a plant or who owns it. It can be caused by accident, carelessness, exposure to some nearby hazard, or a malicious act.

Those heat treaters who have experienced little or no fire loss can count themselves downright lucky. But they should not allow themselves to be lulled into a false sense of security. They may be relying for protection on equipment that in a sudden fire of major size would fall far short of their needs.

It is hoped that this article will stimulate further thought and discussion about ways to safeguard against disaster. Lack of real preparedness may sometime spell the difference between survival of a plant and total destruction.

What Makes a Fire?

The three essentials, of course, are fuel, oxygen, and heat.



The oil quench tank is a frequent cause of severe industrial fires. This is a diagram showing an overhead arrangement of permanently installed CO_2 piping around the quench tank.—Photo courtesy of Randolph Laboratories, Inc.

In heat treating, all of these are present. It doesn't take a detective to find in such plants not only all the usual industrial risks, but more besides. Salt baths occasionally blow up. Atmosphere furnaces have been known to explode. A Cleveland firm was induction hardening when a rubber hose used in spray-quenching oil broke and caused a flare-up. There are also quench tank fires and those that occur when treating certain metals, such as magnesium.

Extra risks call for extra protection.

If we but take away one of the three basic elements, fire will cease to exist. And since it seldom is practical to remove the fuel, the need remains to either (a) smother the flames by reducing the supply of oxygen, or (b) reduce the heat of the fuel. Or better yet, do both at the same time.

A wide variety of smothering agents and extinguishers now are available; but choosing exactly the right ones is not a job for amateurs. What usually is needed is not just one sort but a combination of agents and devices to fit each set of conditions with due regard for the greatest hazards.

Oil Quench Tank Fires

By far the greatest number of fires that occur in heat treating come from quenching hot steel in oil. From the fire protection standpoint this operation should get prime attention. These fires start when oil is allowed to overheat—or when work is not fully immersed so there is localized overheating. Analysis of over two hundred such fires shows:

1. 59% occurred when the work was only partly submerged;
2. 23% were due to overheating of the main body of oil in the tank;
3. 7% were caused by open flames; and
4. 11% originated from causes that could not be determined.

It is very important to note that oil quench tank fires start quite slowly—*beneath* the surface. That's why they always seem to "let go" so suddenly and with such intensity. The heat generated before the outbreak is terrific.

Contamination of the oil can make matters worse. One metallurgist says:

> "We have had three or four nasty quench tank fires usually caused by our lowering gear jamming while work was half in and half out of the oil. In one of the worst, the oil frothed out over the top of the tank and onto the shop floor like a flaming waterfall. Later we learned this frothing was due to the oil being contaminated with water in suspension."

This doesn't mean necessarily that the use of water is unwise. Water is probably the oldest agent ever used for fighting fires, and nowadays the addition of detergents can make it wetter and more effective. Fog from special nozzles or automatic sprinklers — and steam, too — further boost its value. No, quenching into contaminated oil is one thing; using water to smother a fire is something else again.

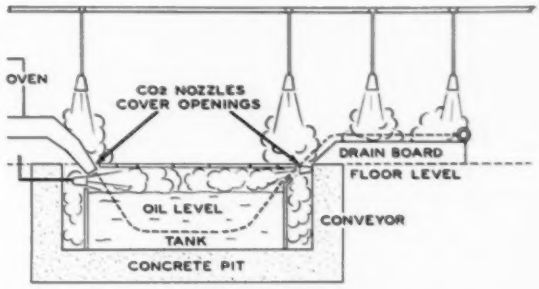


Diagram illustrating an arrangement of piping and nozzles for carbon dioxide gas in a sunken quench tank arrangement. — Photo courtesy of Randolph Laboratories, Inc.

Indeed, one of Factory Mutual Liability Insurance Co.'s bulletins stresses the need for automatic sprinkler protection over oil quench tanks. Their Mr. A. S. Stewart writes:

> "The record of fires in oil quench tanks where sprinkler protection was provided, conclusively indicates that expectable damage will be less than in quench tanks not so protected. It is recognized that discharging water into hot oil may cause temporary boil-over, and many have used this argument against installing sprinklers. Their reasoning, as borne out by our loss experience, is unsound.
>
> "Should other types of extinguishers fail to put out a quench oil fire, hose streams are certainly going to be used, resulting in much more severe boil-over and escape of oil than would be caused by operation of automatic sprinklers.
>
> "Sprinklers give the important *additional* benefit of cooling the building structure and nearby equipment."

A study was made by the National Bureau of Standards of five extinguishing agents: two vaporizing liquids (carbon tetrachloride and chlorobromomethane); carbon dioxide; dry chemical (bicarbonate of soda treated with a moisture repellant); and foam.

These agents were discharged by 15 different small hand-portable extinguishers, on 10 types of fires. Observations showed that the methods of attack yielding best results vary with the kind of fire, and particularly with the extinguisher. Generally, carbon tetrachloride is best employed by spraying it onto a hot surface to secure maximum vaporization, and in a manner that will cover the area with the decomposition products. Dry chemicals are most effective when they cover the whole flaming area at once. Carbon dioxide works

(Continued on page 41)

PAPER WORK FOR A FAST FINISH

By **J. R. GIER, JR.**, President
Ferrotherm Company
Cleveland, Ohio

THE FERROTHERM COMPANY deals principally in service. Our Cleveland plant receives metal parts from hundreds of manufacturing companies, puts these parts through high-quality heat treatment to braze, anneal or harden them, and returns the parts to the manufacturer. But the service we sell most consists of more than heat treatment itself. It also must consist of expediting the handling of these orders so that they are on their way to productive use in the minimum possible time.

This accent on speed is designed to meet the needs of many of our customers. It is not uncommon for us to work on a 24-hour basis, moving an order into our plant, through our furnaces and out again within a day. Two days' handling of an order is considered on the long side. In some cases, notably with a staple item such as sheet metal screws which we bright harden, we receive an order for in-transit processing and when finished, we rush the screws directly to the manufacturer's customer. Aircaft material which we treat is shipped to us air freight and goes out that way when completed. Because of rapid changes in aircraft specifications, these items cannot be back ordered. It is an exception when urgency is not a factor in these orders.

Fig. 1—Francis Gipson, supervisor of receiving and shipping, types 11-part Kant-Slip form on electric typewriter with Registrater Platen. This accomplishes in one writing most of the basic entries needed for work processing, invoicing and shipping. These had to be done separately previously, largely by hand-writing. Photo courtesy of Standard Register Co.

To speed handling of these rush orders and the remainder of the approximately 1,100 orders we receive each month, we have begun using a simple but effective order-processing system. It is keyed to the use of a single set of integrated forms to meet the paper work needs of work-processing, invoicing and shipping operations. The forms are designed to permit a single writing of basic information for all three phases of plant operation, but still to enable us to complete various sections of the forms independently of the others.

Since we have one unit acting as both receiving and shipping departments, speed of handling paper work is an important factor in keeping up a smooth flow of traffic. The introduction of our order-processing system facilitated matters so greatly that we have been able to handle a considerably increased volume of orders with fewer people.

It was the rapid growth in our work volume that led us to call on The Standard Register Company to help us work out an order-processing procedure and to design the forms it required. Ferrotherm started out as a small proprietorship in 1940, utilizing new concepts in the heat processing field, including furnaces in which a pure hydrogen atmosphere is maintained. The company was incorporated in 1946. While heat treating still is our primary activity, other phases of production are growing in importance. Principally, we have become a manufacturer of brazed jet engine assemblies in our Aircraft Components Division. The division also treats other manufacturers' high temperature alloys and stainless steel requiring advanced technology in brazing. Our latest activity, not yet in the production stage, is development of a pin-fin extended surface heat exchanger, which pre-heats air fed into gas turbines to permit a substantial saving in fuel.

To process parts received for heat treatment, including those handled by the Aircraft Components Division, we formerly depended on handwritten work order and shipping forms prepared separately in the shipping department. Most of the information on these forms had to be repeated when invoices were typed later in our office. While the duplication of writing effort was bad enough, it was complicated by the necessity for handwriting the forms.

Fig. 2—Receipts are signed at shipping-receiving department desk by truckers picking up orders. Flow of order traffic is speeded because the sets of shipping memos are already prepared when the order is picked up. Gipson, standing behind counter, inserts shipping memo number with hand numbering machine at left. Photo courtesy of Standard Register Co.

To replace this method, The Standard Register Company designed an 11-part set consisting of three sections—work orders, invoices and shipping memos —on continuous Kant-Slip carbon interleaved forms. These are prepared on an IBM electric typewriter equipped with a Registrator Platen, which keeps all parts of the form in perfect alignment by having pins engage the holes in the margin of the forms. Francis Gipson, supervisor of shipping and receiving, reports that preparation of orders has been greatly speeded by use of the new procedures.

When an order arrives, the shipping department types customer information, date received, customer's order number, item description and the customer's item count on the set. The source material for this data may be the customer's purchase order for packing or delivery slips. The customer's item count appears only on the work order section, which consists of the top three forms. Use of strip carbon eliminates reproduction of the customer's item count on the last eight forms in the set. Later an actual production count will be entered on these forms.

At the time of this original typing, the invoice section of five forms and the shipping memos (three forms) are refolded automatically in separate sets. The invoices are forwarded to the front office and the shipping memos are filed in the shipping department.

The work order set is distributed immediately, as follows: Production Copy—this original goes to the process engineer, who records the various job operations so they may be checked as performed, then to the Production Manager for scheduling. A chart for this purpose is printed on the form. Material Copy—accompanies the material being treated as it moves throughout the plant to identify it. Shipping Department Copy—kept in that department's file.

When processing of an order has been completed, the Material Copy of the work order set is marked as approved for shipment and the material is returned to the shipping department. The shipping memo set then is pulled from a file and completed. This entails writing in of the actual item count as determined by automatic counters at the end of each furnace and of routing information. A shipping memo number is entered with a hand-numbering machine. The Office Copy of this section then is sent to the front office, the Customer Copy to the customer and the File Copy is kept in the shipping department's files.

Receipt of the shipping memo Office Copy in the Ferrotherm office initiates completion of the invoice section. A clerk types in the few entries which have been written by hand on the shipping memo. She also figures price extensions and types them in. The Invoices, in triplicate, are sent to the customer. File and Bookkeeping Copies are kept in the office.

The speed in handling orders with this system is such that what was a 2-man operation in shipping and receiving is handled by only one man under the new system, although order volume has increased. There also is a significant saving in our office, where typists must make only a few entries on the Invoice instead of typing up the entire form.

Fig. 3—J. V. Milligan, Production Manager of Heat-Treating Division, checks the Work Order Production Copy—original copy of the 11-part set—against an order as it moves into an atmospheric controlled furnace for copper brazing. The flames visible at the entrance to the furnace are caused by the burning-off of hydrogen so that it will not create a plant hazard and as an indication that hydrogen is flowing within the furnace. Photo courtesy of Standard Register Co.

Naturally, transcription errors have been all but eliminated with the absence of repetitive typing. These errors had been compounded on occasion because typists had misread lengthy handwritten entries. Now that such entries no longer are made, the problem has disappeared. In general, the order-processing system has enabled us to provide more efficiently the service which is the heart of Ferrotherm's business.

• • •

CARBURIZING COMPOUND HANDLING AND DUST CONTROL

By **ANTHONY J. BECK,** Chief Engineer
Commercial Steel Treating Corporation
Detroit, Michigan

A COMPACT unit consisting of a Dust Booth, Multi-Swirl Wet Dust Collector, Dump Hopper, Cleaning Machine and Storage Hoppers with rotary locks for proportional mixing of the compound was recently installed at the Commercial Steel Treating Corporation's Plant No. 1. The new and old compounds are conveyed pneumatically from the Dump Hopper to the Storage Hoppers and the dust from handling the material as well as from dumping and cleaning is removed by passing the air through the Multi-Swirl Wet Collector. The air is then returned into the building room. (See Fig. 1)

The dust booth is 16′-0″ wide x 14′-0″ deep x 8′-0″ high and encloses the cleaning machine and

Figure 1

dump hopper. The front of the booth is open with sufficient air velocity to prevent any dust getting into the room. A large duct with adjustable slide openings covers three sides of the booth for removing dust from the booth, cleaning machine and dump hopper. The dust laden air is drawn through the Multi-Swirl Wet Dust Collector which forms one side of the booth and the cleaned air is blown back into the room. (See Fig. 2)

The dump hopper is located at the left side of the booth adjacent to the wet collector. It has a water jacket which is part of the collector tank for cooling the hot compound before it is conveyed to the storage hopper. There are also six 2″ water cooling pipes welded into the dump hopper for additional cooling. The cooling water which is the same water used in the collector is circulated through the hopper jacket and tubes by the action of the collector pump. This eliminates the use of running water or an extra pump. The dump hopper has a grating at the top that collects the work while the compound falls through the opening into the hopper. A gravity roller conveyor with the same height from the floor as the furnaces and dump hopper is used to convey the containers from furnaces to dump hopper. An extra heavy pipe with adjustable or orifice connection to the bottom of the hopper and running through the collector water tank for additional cooling pneumatically carries the compound to the reclaim storage hopper. New compound is poured into this same dump hopper and pneumatically conveyed to the new material storage hopper. This is accomplished by a manually operated damper in the conveying pipe at the top of the storage hoppers that directs the material into either the new or reclaim hopper. This allows the use of only one conveying pipe for both new and reclaim material.

The storage hoppers are located adjacent to the collector making a very compact unit. The hoppers are built as a two compartment unit with a capacity

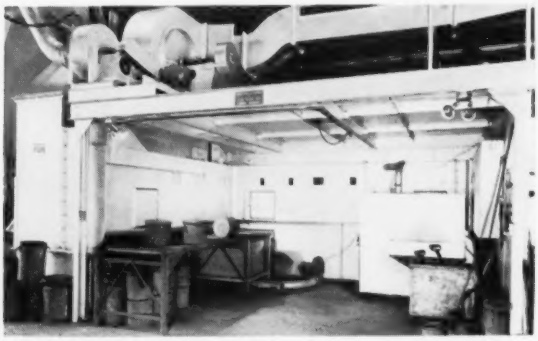


Figure 2

of one and one-half tons of material in each compartment. The lower half of each compartment is tapered to 10″ x 10″ and each compartment has a 10″ rotary lock. The two rotary locks are piped into one 9″ diameter outlet which extends to a point just above a factory hand truck. The rotary locks are driven at different speeds to give the proper mixture of new

(Continued on page 51)

"Park Chemical Gave Us 50% Greater Production In Heat Treatment of Saw Blades"

Says Ray Uhl

Chief Metallurgist, Henry Disston Division, H. K. Porter Company, Inc., Philadelphia.

"One of the great advantages of using Park's salt baths is the uniform temperature, prevention of decarburization and the maintenance of excellent straightness that is obtained.

"We have stepped up production heat treatment 50% by preheating saw blades in Park's Nu-Sal Neutral Salt at 1600 degrees F. for 1½ minutes. Then we transfer to Park's high heat bath at 2200 degrees F for 45 seconds, and quench in neutral salt operating at 1100 degrees F.

"We have been using Park products for many years and have found that day-to-day uniformity of quality and the excellent service guarantee a high quality Disston saw blade."

Park neutral salts are balanced mixtures designed to provide positive neutrality, excellent fluidity and great stability. Their melting points and working ranges have been planned to furnish a neutral salt for every heat treating temperature from 925° to 2400° F.

Park Laboratory Control, from raw material to finished product, insures the quality and uniformity of all Park Heat Treating Salts. For information regarding your specific requirements, write Park Chemical Co., 8074 Military Avenue, Detroit 4, Michigan.

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PARK CHEMICAL COMPANY

8074 Military Avenue
Detroit 4, Michigan

THE SECONDARY BOYCOTT

An interview with Mr. Hoyt P. Steele, President, Benjamin Electric Manufacturing Co., Des Plaines, Ill., and Chairman, National Chamber of Commerce Special Committee on Secondary Boycotts.

Mr. Steele, as a businessman who has been a leader in the fight for federal legislation against the union secondary boycott, what is the picture for legislative relief?

Success will depend upon showing Congress the tremendous public costs and moral evils of the secondary boycott. Fortunately, there are two identical bills in the Congress now that would put an end to the secondary boycott and pave the way for responsible unionism and a true spirit of collective bargaining. They are S. 76 and H.R. 9307. S. 76 was introduced on the third day of the 85th Congress by Senator Carl T. Curtis of Nebraska, and H.R. 9307 was introduced in the closing days of the first session by Rep. Lawrence H. Smith of Wisconsin.

If the Taft-Hartley Act has been unable to stop union secondary boycotts, how would S. 76 or H.R. 9307 do it?

As I read them, they are essentially loophole closers, introduced as an amendment to the so-called secondary boycott provisions of the Taft-Hartley Act —Section 8(b)(4).

Ten years ago when the 80th Congress passed Taft-Hartley, it tried to stop the union bosses' power to involve neutrals in labor disputes or union organizing drives. The secondary boycott is nothing more than an attempt to draw the public and neutral business firms and their employees into the labor problem—real or fancied—of others.

How does the secondary boycott work?

A simple common example would be the case of a television station that is trying to negotiate a new collective bargaining contract with the union that represents its employees. If the union can't win its demands at the bargaining table, it may call a strike. But if the strike doesn't bring enough economic pressure, the union official may resort to a secondary boycott. That's when collective bargaining then becomes collective bludgeoning!

What do you mean collective bludgeoning?

Well, the union leaders contact the sponsors of TV programs and threaten the sponsors with 'labor trouble' unless they agree to cancel their shows. The idea, of course, is to bring economic pressure upon the neutral businessman and his employees unless the firm takes the union's side in its contract dispute with the TV station. There is no concern for neutrals or fairness.

What will S. 76 and H.R. 9307 do about this situation?

Well, this is just one of the half-dozen or so loopholes that the Curtis-Smith bill would close. They also would put an end to such other loopholes as hot cargo secondary boycott contracts, secondary picketing, coercion of employers, and the other dodges to get around the Taft-Hartley prohibitions on secondary boycotts.

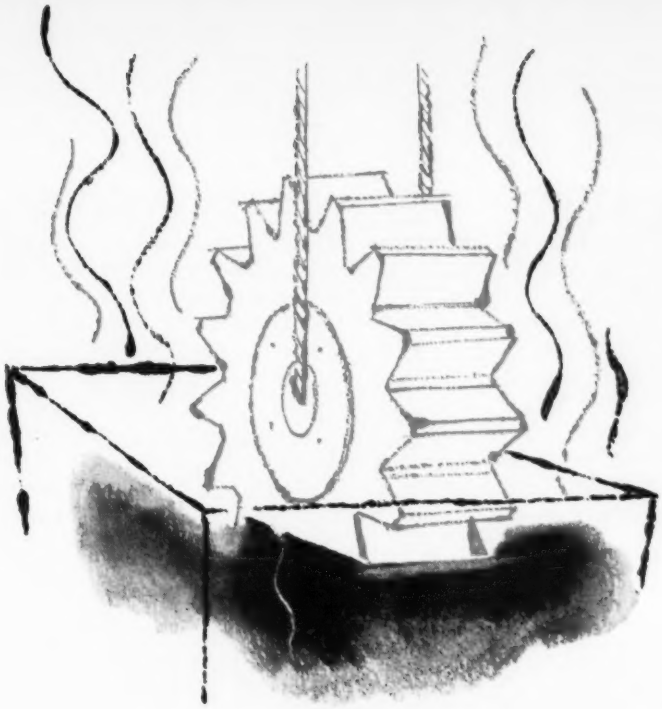
Can you cite examples of how these loopholes are used?

That's easy. First, take the Burt Manufacturing Co. of Akron, Ohio. They are victims of two loopholes: employer pressure and witholding employees. Burt has a compulsory union shop contract with the AFL-CIO steelworkers; yet, the AFL-CIO sheetmetal workers have refused to install Burt-made ventilators on jobs all over the country. Contractors are told they'll have labor trouble if they buy Burt products. This threat is made only to the contractor as an employer. It is legal because Taft-Hartley requires employees to be pressured; it makes no mention of employers.

But if the contractor doesn't scare easily, the union boss uses the very effective second loophole. When he notes Burt products on the construction job, he merely refuses to supply the contractor with sheet metal workers if the contractor plans to install Burt merchandise. This technique was held to be beyond the law in the old Joliet Contractors case decided back in 1953.

The decision was based on the law's requirement

(Continued on page 48)



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Induction Hardening of Cast Iron

Millions of tons of iron castings are produced by the foundries of the United States each year. While the greatest portion of these castings requires no hardened surfaces, many cast machine-parts would offer improved performance if they could be hardened on one or more surfaces. Among these machine-parts are all shapes of cams, gears, cam shafts, lathe beds, etc. High frequency induction heating may be used successfully to provide such hardened surfaces if proper consideration is given to the prior microstructure and to the hardening procedure.

Types of Cast Iron

Several types of cast iron are used industrially, including gray iron, chilled or white iron, malleable iron, pearlitic malleable iron and ductile iron. The principal difference in the various types of cast iron is the form in which the carbon is present in the microstructure; i.e., whether in the combined state, as is true in steels, or as graphite. The form of the carbon in turn depends upon such factors as the composition of the casting, particularly with respect to carbon and silicon content; the cooling rate; special addition agents to the liquid metal prior to casting; and heat treatment of the castings after removal from the mold. Slow cooling rates combined with high silicon and high carbon content, for example, promote the separation of carbon as graphite flakes. Likewise, reheating of castings to 1650°F followed by very slow cooling promotes formation of graphite. Table I lists the types of cast iron, their approximate compositions, and the form of carbon observed in each type.

That portion of the total carbon content in cast iron which is in the combined state behaves in essentially the same way during induction hardening as it would in a steel of the same carbon content. The graphitic carbon, whether present as flakes in gray iron, as temper carbon in malleable iron, or as spheroidal graphite in ductile iron, behaves essentially as an inert material remaining without appreciable change in the rapid heating cycles typical of induction heating. It is apparent that for induction hardening the combined carbon content and not the total carbon content is of greatest importance. To be successfully hardened by induction heating, a cast iron should contain more than 0.35% combined carbon. As the combined carbon content increases, the hardness obtainable increases reaching a maximum when the combined carbon content is approximately 0.6% to 0.8%. Thus the types of cast iron which can be successfully hardener are those containing considerable amounts of combined carbon preferably as a pearlitic matrix. Table I indicates the types of cast iron which can be successfully hardened by induction. These include gray, pearlitic malleable, ductile cast iron and a controlled commercial gray iron, Meehanite.

Response and Results To Be Expected

Given suitable prior microstructures, such as those shown in Table I, induction hardening of cast iron parts offers no particular problem. The recommended hardening temperatures shown in Table I provide for formation of austenite containing undissolved graphite upon heating, while quenching causes formation of martensite. Excessive hardening temperatures or extended time cycles cause solution of some graphite and a tendency for retained austenite upon quenching with a decrease in hardness. The hardness values to be expected as a result of induction hardening each type of cast iron are also given in Table I.

Frequently, tempering after induction hardening cast iron is not necessary. In applications involving high compressive loads, however, tempering at 400-700°F may be desirable to restore some ductility; and in the case of gray cast iron to increase substantially the bend strength without appreciable loss of hardness.

Perhaps the greatest difficulty encountered in hardening cast iron by induction is lack of uniformity in castings made from various melts. When foundry control is lacking, wide variations may occur in the amount of combined carbon content and therefore the prior microstructure from lot to lot of castings. Thus a lot of castings having a combined carbon content of 0.5% to 0.6% and an essentially pearlitic matrix responds well to induction heating, while the next lot having a combined carbon content of 0.2% to 0.25% and a matrix consisting primarily of ferrite with little pearlite gives low hardness.

Ductile Cast Iron Cams

Fig. 1 shows the coil arrangement developed for surface hardening the contour of ductile cast iron cams. The hardness pattern

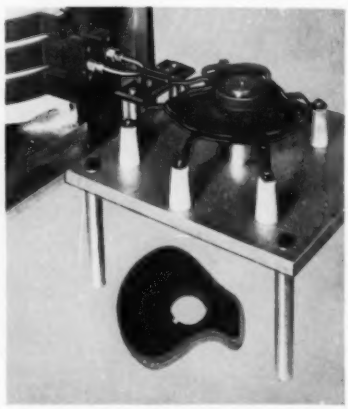

Fig. 1—Coil arrangement for surface hardening the contour of ductile cast iron cams. A macroetched cam is shown below the fixture.

(Continued on page 17)

April—Ammonia storage tank installed without supervision by supplier "Z"...

Later—Leaks! Getting improper flow of ammonia . . .

Still later—Discovered certain vital equipment improperly installed . . .

Too late—Safety and efficiency at danger point, shut down line to make repairs . . .

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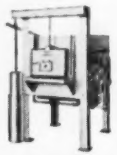
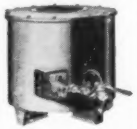
SURFACE

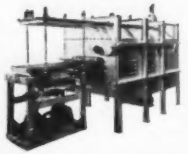

small oven

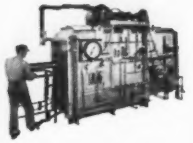
laboratory

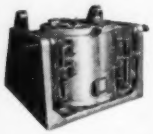

circular pot

rivet heater

rectangular pot


continuous snap hearth


continuous link belt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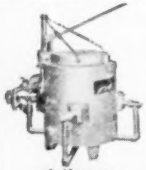
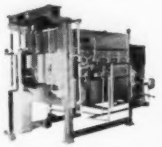
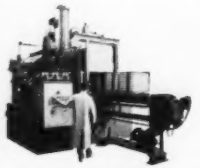

stationary metal melting

forge

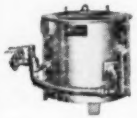
horizontal muffle

MDX® gas generator


balco® atmosphere

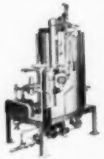

allcase® atmosphere

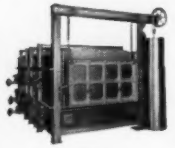
soft metal melting

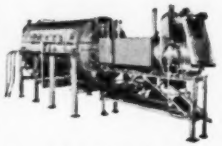

aluminum melting-holding

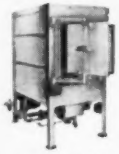
brazing

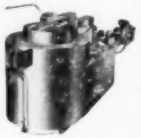
indirect air heaters

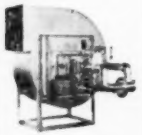

MRX® gas generator


large oven


stainless steel

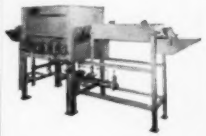

horizontal convection


vertical convection


direct air heaters

vertical muffle

MAX® gas generator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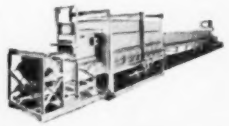
continuous brazing

widest selection

You can select exactly what you need from the broad Surface line of Standard Rated equipment. Modifications are possible for unusual requirements.

known production rates

Rated production makes it easy to determine quantity of finished product which a Surface unit will produce in any given time.

known operating costs

Figures and performance curves on all units clearly show in advance your operating cost per pound of finished product.

quick delivery

Surface standardization permits stocking the same parts for many different furnaces; cuts engineering and procurement time.

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2381 Dorr Street, Toledo 1, Ohio. In Canada: Surface Industrial Furnaces, Ltd., Toronto, Ont.

Surface

wherever heat is used in industry

HEAT TREATING HINTS

(Continued from page 14)

obtained is illustrated by the macro-etched cam shown below the fixture. It is apparent that the induction hardening operation has produced a relatively uniform case about the periphery of the cam. Hardness on the cam surface was uniformly Rockwell "C" 52-55.

While the cam shown was processed with a 15 KW unit using a 18 second time cycle, a wide selection of case depth is possible, using high frequency generators (300 to 500 Kc per sec.) by varying the power input.

Suitable prior microstructures for induction hardening ductile iron parts may be obtained, either by heating the castings to 1600-1700°F for 1 to 2 hours followed by isothermal transformation at 1100 to 1300° F.; or by quenching from 1600 to 1700°F followed by tempering in the temperature range 1100 to 1300° F for one or more hours. Such preliminary heat treatments provide a wide range of mechanical properties for engineering service.

Cams of the type shown may be treated to provide cam properties of 90,000 psi tensile strength, 68,000 psi yield strength, 12% elongation and an impact resistance of 58 ft.-lbs. (unnotched Charpy). Such a combination of properties combined with the high surface hardness achieved by induction hardening, i.e., Rc 50/58 in finding an increased number of applications in machine-parts. • • •

Source—HIGH FREQUENCY HEATING REVIEW, Vol. 1, No. 2

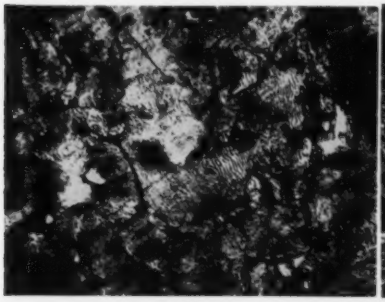


FIG. 2

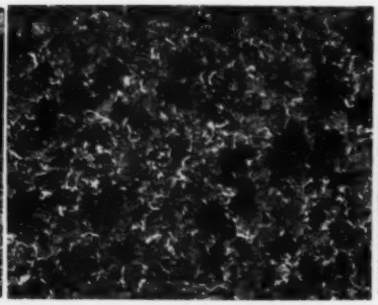


FIG. 3

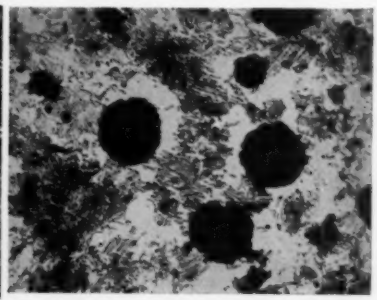


FIG. 4

Microstructures of (2) gray cast iron, (3) pearlitic malleable cast iron and (4) ductile cast iron considered satisfactory for induction hardening. Gray cast iron (2) shows random graphite flakes in a pearlitic matrix (approx. .8% combined carbon); pearlitic malleable (3) shows temper carbon nodules in pearlitic matrix; and ductile iron (4) shows graphite spheroids in a ferrite-pearlite matrix.

TABLE 1 — Induction Heat Treatment of Cast Irons

Type	Approx. Composition Total % C.	% Mn	% Si	Form of Carbon	Successfully Hardened?	Recommended Hardening Treatment Temp.	Quench	Comments	Hardness Expected
Gray	3.0/3.8	0.5/0.8	1.7/2.5	Combined 0.1/0.8, graphite flakes remainder	Yes, if combined carbon .4% consistently	1600/1700°F	Water	Hardness increases as combined carbon increases	Rc 45/55 —
White	2.5/3.0	0.5/1	1/1.25	All combined as massive carbide	No	—	—	No hardening desired	—
Malleable	2.5/3.0	0.3/0.75	0.8/1.5	Essentially all graphite as temper carbon	No	—	—	—	—
Pearlitic Malleable	2.5/3.0	0.5/1.	0.8/1.5	Combined 0.5/0.8 remainder graphite as temper carbon	Yes, generally very suitable	1600/1700°F	Water	—	Rc 48/58
Meehanite	Made to physical specifications			Combined 0.8/0.9 remainder as fine well distributed graphite flakes	Yes, Types GA, GB, GM, particularly suitable	1550/1650°F	Water	—	Rc 50/58
Ductile	3.2/4	0.8 max.	1.7/2.8	Combined 0.1/0.8 graphite spheroids remainder	Yes, if combined carbon .3% consistently	1650/1700°F	Water	—	Rc 50/58

M.T.I. *Activities*

PHOENIX SPRING MEETING

The 1958 Spring Meeting of the MTI was held April 21-23 at the Camelback Inn in Phoenix, Arizona. The attendance was excellent with almost a total of 90 people participating including members and their wives and children.

The program began informally Sunday evening with a "Get-Together" cocktail party held in the lounge of the Inn known as The Cholla.

The meeting was officially opened Monday morning with a presentation by Mr. William Holaday, Ass't Secretary of Defense for Guided Missiles, entitled "Present and Future Missiles." He predicted that the United States would have operational intercontinental ballistic missiles before the end of 1959. Also, that even though the U.S. doesn't have effective defenses against ICBM's at present, that Russia is not ahead of America in overall missile development.

After an interesting discussion period with Mr. Holaday answering questions from the members concerning the role of the heat treater in relation to the future missile program, a film was shown entitled "More Than Just Steel" which was produced by the Armco Steel Co.

A Buffet-style luncheon was served around the swimming pool each day, and the feature of Monday evening was a private dinner party for the entire group in the form of a "Steak Broil" at the foot of Mummy Mountain. Cowboy music and entertainment was provided together with group singing.

Tuesday's technical session featured a presentation by Cliff Cook of Cook Heat Treating Co. of Texas who read a paper written by Charles Lewis of the same company entitled "A Practical Application of the Tempering Parameter Technique to the Heat Treatment of 410 and 416 Stainless Steels." Mr. Cook answered many questions from the group and then the movie "Production 5118" dealing with the problems of industrial psychology and communications was shown.

The highlights of Wednesday's program were the presentation by Mr. C. F. Olmstead, President of Lee Wilson Engineering Co., Inc., and President of the Industrial Heating Equipment Association, entitled "The Design, Engineering and Construction of Heat Treating Furnaces" and the Forum Discussion lead by Mr. Fred Heinzelman, Jr., of Fred Heinzelman & Sons on the subect "Cost Savings of the Year." During the discussion period, Mr. Olmstead asked for specific answers to some specific questions he asked the members concerning their relations with heat treating furnace manufacturers and their salesmen.

During Mr. Heinzelman's Forum many cost saving ideas that had been submitted earlier by various members were discussed and many new ideas were given from the audience.

Wednesday evening saw the convention end with the reception, banquet and dance.

(Continued on page 46)

Ass't. Secretary of Defense for Guided Missiles, Mr. William Holaday, is being greeted by members of the Metal Treating Institute as he arrives at the airport in Phoenix, Arizona prior to his addressing their Spring Meeting. Shown (left to right) are: Past-President C. M. Cook; Vice-President Al T. Ridinger; Mrs. Ridinger; Mr. William Holaday; Mrs. Cook; and Executive Secretary, C. E. Herington.

Mr. K. U. Jenks, President of the Metal Treating Institute, examining pictures of various types of missiles with Ass't. Secretary of Defense for Guided Missiles, Mr. William Holaday.

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributors: Bethlehem Steel Export Corporation

Hundreds of red-hot wrenches per hour formed and broached with 57 HW

Forming and broaching twelve-point openings in box wrenches from red-hot alloy steel bars is a job that calls for a hot-work tool steel having a high red-hardness . . . good resistance to abrasion . . . and the ability to take shock.

Our 57 HW grade meets these tough requirements—and then some—at P & C Tool Co., Milwaukie, Oregon. Hardened to Rockwell C-50, the die turns out wrenches from rounds of special alloy steel, similar to 4140 grade. After producing approximately 3500 wrenches, the punches and dies are polished with an emery roll, putting them in good shape for some more of the same rugged service.

57 HW is our 9 pct tungsten type of hot-work tool steel. Hardened in air, it has both high red-hardness and high abrasive-resistance. Moreover, it offers good resistance to heat-checking, and more than holds its own in resisting shock.

Typical Analysis

Carbon 0.35	Tungsten 9.35
Chromium 3.25	Vanadium 0.50

57 HW is ideal for a variety of hot-work applications—everything from hot headers to spike cutters, from punch-and-die inserts to nut piercers. Why not let a trial run convince you? Your Bethlehem tool steel distributor is awaiting your call.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Take a Good Look At Your Grinding Marks

Some people are surprised to learn that grinding marks often play a big part in determining tool life. This is especially true with deep-hardening dies and punches that have a moving contact with metals under high pressures. Although the surface finish of a ground tool may appear smooth, it actually has a saw-tooth contour. Material moving in the same direction as the grinding marks shows less tendency to "pick-up" or adhere, than material which travels across the grinding marks.

This "pick-up" of material is not desirable on such tools as drawing dies. Here it is advantageous to grind in the same direction as the material is to move. On some types of tools this kind of grinding is difficult, but because of the longer tool life obtained, the effort is worthwhile.

Punches which have been ground longitudinally outlast those which have been ground circumferentially, though the latter is by far the most common method. Here, too, longitudinal grinding pays off, even though it may be inconvenient.

It's well to give serious thought to the direction of grinding on tools. It can make a big difference in getting the best possible tool life.

It's just off the press—a completely new two-color booklet on Bearcat tool steel. The booklet is profusely illustrated, and explains fully why Bearcat is such an outstanding grade for a wide variety of shock applications. If you would like to have a copy for reference, write to Publications Dept., Bethlehem Steel Company, Bethlehem, Pa. Ask for Booklet 458.

NEWS TO HEAT TREATERS...

HEAT TREATING & ART AT BRUSSELS WORLD'S FAIR

As one of many examples of American Modern Art, the Museum of Modern Art of New York City will exhibit at the World's Fair in Brussels, Belgium, a heat-treated coil wire rooster made of beryllium copper. Sponsored by the United States Government, the Educational Department of the Museum directed by Mr. Victor D'Amico, will display the "Crowing Rooster" as shown here as an example of metals in art by artist Ruth Vollmer.

After the annealed form was wound and silver soldered the entire structure required heat treatment to maintain the correct position and increase resiliency. In order to keep the coils in proper relation during and after treatment a special heat treating fixture was designed by Fred Heinzelman & Sons. Final operation consisted of fine liquid blasting, to impart a matte finish enhancing the metalic copper color.

HIGH TEMPERATURE ATMOSPHERE FURNACE

A new high-temperature, atmosphere tube furnace has been announced by the Pilot Plant Equipment Division of Lindberg Engineering Company.

The Type GT-34 furnace is supplied with a metal-ceramic tube assembly, complete with blast gates and automatic flame curtains at both ends. The large tube (4" I.D.) is ideal for a wide variety of heat treating applications requiring protective atmosphere at temperatures up to 2750°F (1510°C). A water-jacketed cooling chamber enables the cooling of work while under protective atmosphere.

The furnace is a self-contained

unit with all electrical components in the bottom portion and is prewired and piped.

For further information circle No. 1

DIRECT READING SPECTROMETER

A new direct reading spectrometer developed by the Jarrell-Ash Company of Newtonville, Mass., completes analysis of both ferrous and nonferrous metals and alloys within 30 seconds—and instantly registers concentrations of up to 30 alloying elements simultaneously on easy-to-read dials.

Dubbed the "Atomcounter," this 2.5 meter direct reading spectrometer was specially designed for metal producers requiring on-the-spot analysis of production metals.

For further information circle No. 2

PROTECTIVE ATMOSPHERE ANNEALING

A General Electric 10,000 CFH Neutralene (Registered Trade Mark of General Electric Company) gas producer was recently installed in the Ironton, O., plant of the Dayton Malleable Iron Company where Neutralene gas is now being used as a protective atmosphere in annealing furnaces.

Components of the producer are an absorbing tower and fog suppressor and the re-activating tower in combustion chamber of boiler.

Dayton Malleable Iron Company is using Neutralene gas in the manufacture of castings.

For further information circle No. 3

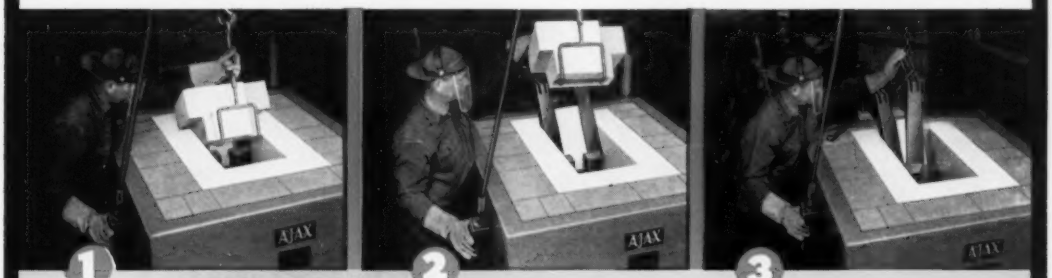
(Continued on page 22)

CHANGE AJAX SALT BATH SUBMERGED ELECTRODES

. . . almost as fast as you'd change a tire!

✓ in about an hour per pair ✓ often while the salt remains molten

✓ without tearing down either furnace or pot



1 A closely fitted but readily removable tile block on top of the furnace seals the new Ajax removable submerged electrodes from air. Electrodes are exposed for easy replacement just by lifting the tile. No skilled labor is needed.

2 Electrodes enter furnace from the top and slant into the bath. There are no furnace openings whatever below the salt line. And there is no need to tear down any part of furnace or pot in changing electrodes!

3 Lift old electrodes out from the top . . . make replacements in about an hour per pair. In many cases, the job can be done while the salt bath remains molten, without even shutting the furnace down.

AJAX

HULTGREN

SALT BATH FURNACES

Internally heated–Electric and gas-fired types.

AJAX ELECTRIC COMPANY

940 Frankford Avenue
Philadelphia 23, Pa.

No more lost production time when salt bath electrode changes are necessary! This revolutionary Ajax design development reduces the job to a matter of minutes . . . and reduces maintenance costs accordingly. Moreover, pot life is vastly increased because the pot is no longer torn down in the electrode changing process. Equally important, although Ajax Removable Submerged Electrodes are made of non-critical materials, their life materially exceeds that of nickel alloy electrodes of conventional design.

Write for Ajax Bulletin 810

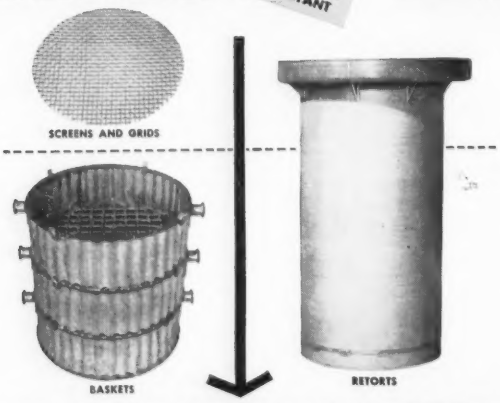
Associates: Ajax Engineering Corp., Ajax Electrothermic Corp.

AJAX HAS THE ANSWERS TO SALT BATH HEAT TREATING PROBLEMS!

"FORGET YOUR SHOP HEAT-TREATING METHODS, THAT CAKE DOESN'T HAVE TO BE QUENCHED!"

ROLOCK

SPECIALIZED WELDED HEAT AND CORROSION RESISTANT FABRICATIONS



ROLOCK "ALL THE WAY"

for a better operating cost picture on your pit-type furnaces

Rolock has so many successful pit-type furnace equipment installations . . . so *many satisfied repeat customers* . . . that we feel very confident in promising you equal satisfaction.

Furthermore, we make *all* the basic equipment needs for pit-type furnaces of every popular size and type . . . retorts, screens, grids, baskets, fixtures, or specially designed work carriers. In each you will find unique ROLOCK design and construction features that are PROVED life-lengtheners . . . performance-improvers . . . long-term cost-reducers.

The best way to gain these benefits is to try us out on your next order . . . either for "standardized" items or special needs. A letter or 'phone call will get prompt action.

SALES AND SERVICE REPRESENTATIVES FROM COAST TO COAST

ROLOCK INC., 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work Easier Operation, Lower Cost

SRL.560

NEWS TO HEAT TREATERS

(Continued from page 20)

INDUCTION HEATER ASSEMBLY

An innovation which saves on overhead costs for users of high-frequency induction heaters in the metal working industry was recently announced by the L. C. Miller Company of Los Angeles.

Trade-marked Miller Re-Coil, it standardizes and simplifies the interchange of work coils, long a problem to the industry. Work coils can now be replaced in a matter of seconds.

The product is a terminal assembly and is available in models to fit any induction heater. It remains in a fixed position and contains all operations and fixtures within it. Therefore, costly shut-down time is eliminated and proper terminal alignment is assured.

For further information circle No. 4

HEAT TREATMENT COATINGS

Ace Laboratories of Lakewood, Ohio developed a series of new products—Altex Hi-Heat Shield (pat. app. for)—for use on titanium and zirconium alloys to prevent absorption of hydrogen, scaling and pitting during heat-treatment at 1250-1875°F. This material has been used over ferrous metals up to 1875°F to prevent decarburization and as a permanent, high-heat finish on missile parts.

It is easily applied by brush, spray or roller-coating. It dries fast and is easily removed by quenching or blast after heat-treatment.

For further information circle No. 5

BENCH-TYPE FURNACES

Thermo Electric Mfg. Co. has announced the addition of four completely new electric, bench-type furnace models to its TEMCO line of industrial and laboratory products. Designated collectively as "Type 1800 Furnaces", they all have the same chamber dimensions, case size and general construction but differ in power requirements (single or three-phase) and

(Continued on page 24)

Leco designs new furnaces around Norton "HOT RODS"

Leading lab furnace builder reports longer life and other advantages of CRYSTOLON* heating elements

The new LECO Model 542 Box Furnace — equipped with long-life CRYSTOLON heating elements — is shown above. Other new Hot Rod-equipped LECO furnaces include two tube and four tube models.

LECO Laboratory Equipment Corporation
Manufacturers of Precision Control Equipment

St. Joseph, Michigan

January 15, 1958

Norton Company
Worcester 6, Massachusetts
Attention: Mr. W. H. Davenport
Refractories Sales Engineering Dept.

Gentlemen:

At LECO we have been so impressed by the advantages of CRYSTOLON heating elements that we have designed our complete new line of resistance furnaces around them.

When these new furnaces were exhibited at recent trade shows, they created an overwhelming amount of interest. Our customers and prospects were particularly impressed by the fact that two years of field tests revealed that CRYSTOLON elements have far superior life to ordinary elements.

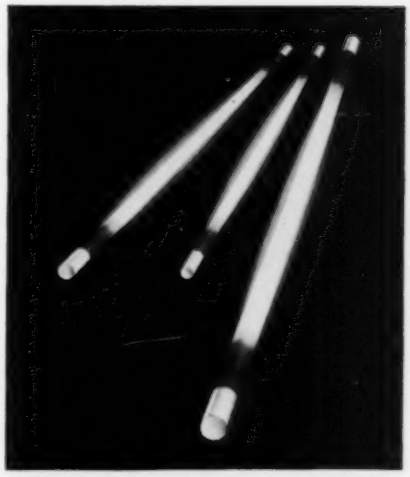
As you know, the way for a firm to advance is to bring progress to its customers, and we really feel we are bringing the latest in technological advances to our customers with Norton Hot Rods.

Very truly yours,
LABORATORY EQUIPMENT CORPORATION

H. J. Schmitt

H. J. Schmitt
General Sales Manager

HJS: rm
Enc.



CRYSTOLON Heating Elements, or "Hot Rods", are a typical Norton Rx — an expertly engineered refractory prescription for greater efficiency and economy in electric furnace and kiln operations. Made of self-bonded silicon carbide, each one-piece rod has a central hot zone and cold ends. Aluminum-sprayed tips and metal-impregnated ends minimize resistance and power loss. Available in standard sizes.

Similar reports from many other plants mean that you, too, can save with "Hot Rods" because their extra long life greatly reduces replacements. Also, you get reduced maintenance due to less changing of elements and voltage taps. One-piece, non-welded "Hot Rods" are strong and straight . . . help protect product quality because their slow, evenly matched rate of resistance provides more uniform heating quality . . . and they are packed shockproof to reach you unbroken. For further facts send for booklet *Norton Heating Elements.* NORTON COMPANY, Refractories Division, 624 New Bond Street, Worcester 6, Massachusetts.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
REFRACTORIES
Engineered... Rx ...Prescribed
Making better products . . . to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

100% INCREASED OUTPUT

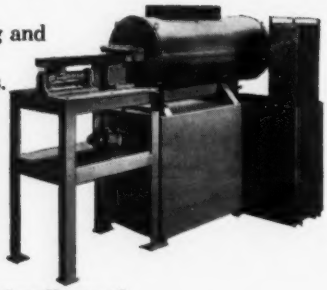
OPERATING COSTS CUT 50%

with this

Hevi-Duty SHAKER HEARTH FURNACE

These facts are reported by William T. Courtney of the Courtney Heat Treating Company, in Cuyahoga Falls, Ohio.

This firm has been neutral hardening and carbonitriding springs and rasps of stainless steel, spring steel and alloys. Production has increased from 45 to 50 pounds per hour to 90 to 100 pounds per hour. Maintenance costs have been reduced, there is an exact duplication of quality, and the furnace has the ability to do several heat treating jobs. In addition, they like the ease of operation and handling of parts, the cleanliness of operation and the positive control of temperature.



If you bright harden, carburize, or cyanide small parts, write for Bulletin 850 to see if the Hevi-Duty Shaker Hearth Furnace can save you time and money.

HEVI-DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN

Heat Treating Furnaces... Electric Exclusively

Dry Type Transformers *Constant Current Regulators*

NEWS TO HEAT TREATERS

(Continued from page 22)

top temperature limits (2000° or 2300°F). All models are for direct, across-the-line operation.

For further information circle No. 6

VACUUM HEAT TREATING FURNACE SPECIALIST

Harry O. Walp, Jr., who has had extensive field sales experience for the company in the New York, Philadelphia, and New England territories, has been named product manager for vacuum heat treating furnaces for the Vacuum Equipment Division of F. J. Stokes Corporation, Philadelphia, according to an announcement by David E. Stokes, manager of the division.

Stokes is one of this country's largest manufacturers of high vacuum processing equipment, including vacuum melting and degassing of metals, vacuum heat treating, vacuum plating, and vacuum drying; as well as compacting presses for powder metallurgy, plastics molding, pharmaceutical compacting, and ceramic and other industrial tabletting operations.

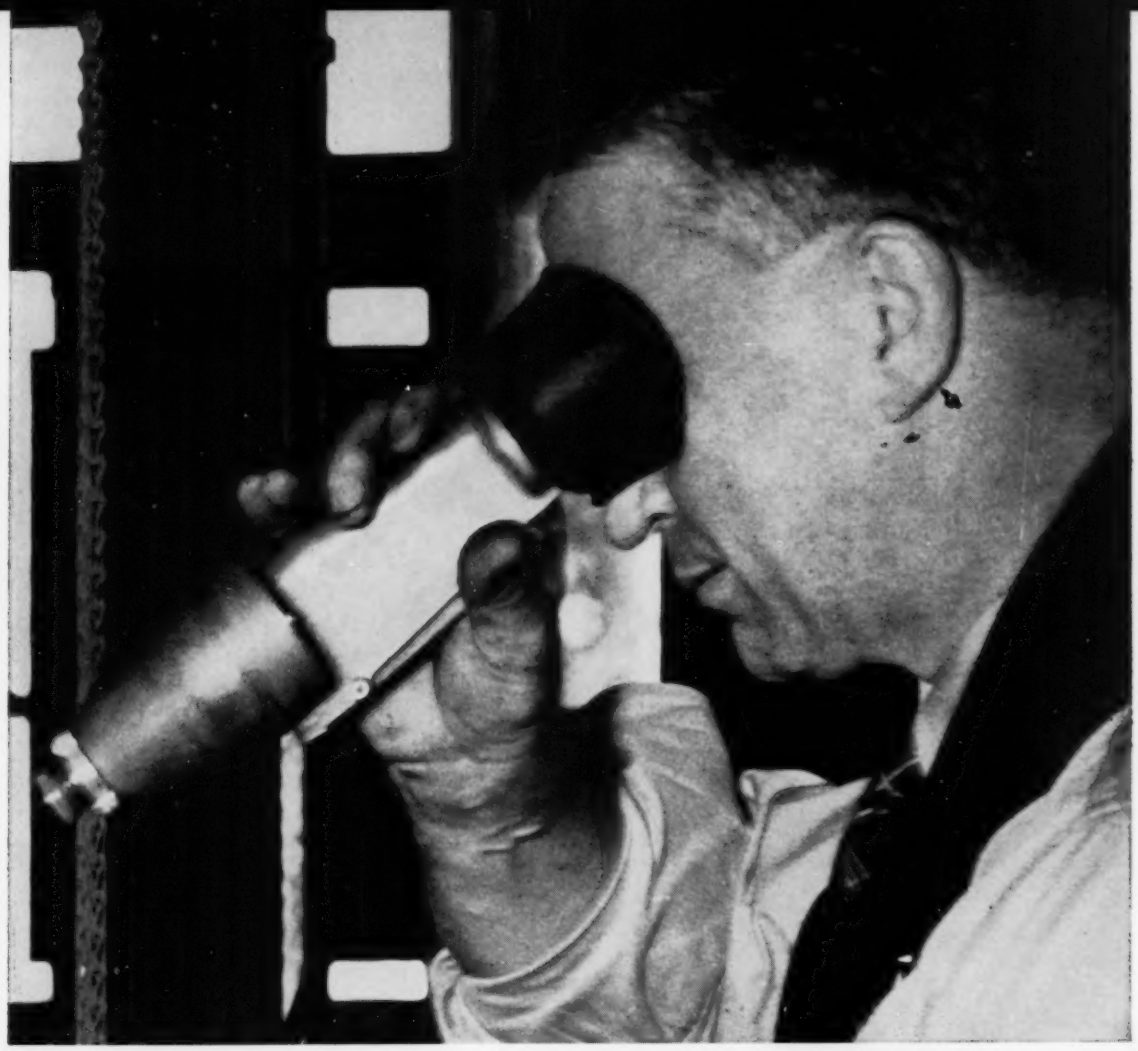
For further information circle No. 7

INDUSTRIAL FIRE HAZARD PROTECTION

Carbon dioxide, shown starting discharge, is a very efficient protection against the flash of fire in an oil filled quench tank, one of industry's most common pieces of production equipment. Of equal importance is the fact that quench tank fires rank high on the list of causes of industrial fires.

Walter Kidde & Company, Inc. states that automatic carbon di-

(Continued on page 26)



won't quit 'til he sees results...

That's the "difference" in Houghton heat treating salts.

Heat treating salts are something like a highway . . . no good to you unless they take you where you want to go. You buy for results, not a price per pound.

That's why it has always been Houghton's policy to make sure Houghton heat treating salts give you the results you want. The Houghton man not only makes recommendations; he sticks with the job, stays right on top of problems until they're solved. This kind of experience has given Houghton the solutions to many hundreds of problems in salt bath heat treating. Out of it have come new salts and new ideas for better control of heat treating results.

Write for the "Liquid Salt Bath" book today. A new printing is now available. E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pennsylvania.

HOUGHTON HEAT TREATING COMPOUNDS

Solid Carburizers:

NUCARB	"Non-burning"
PEARLITE / **QUICKLIGHT**	Various types of binders and standard meshes.

Salt Bath Materials:

PERLITON	Liquid carburizers.
LIQUID HEATS	For hardening, annealing, preheating and treating all steels, including high speed steel.
DRAW TEMPS	For drawing and tempering.
MAR-TEMP SALT	For interrupted quenching, to minimize warpage and distortion.

products of... E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

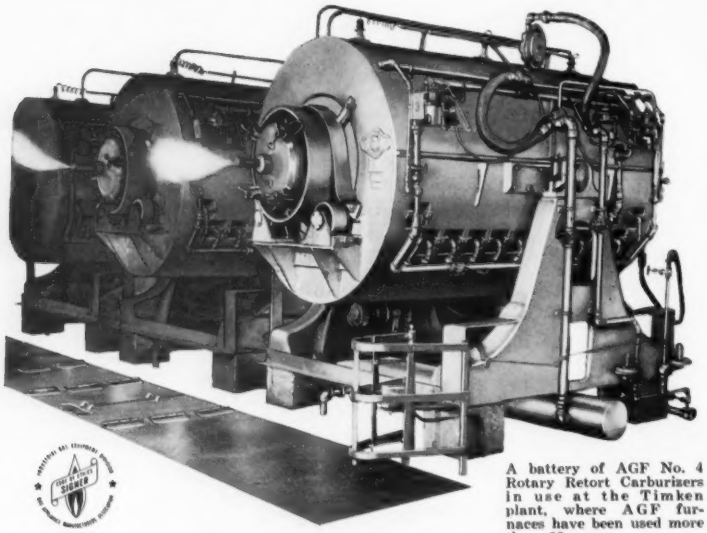
Ready to give you on-the-job service . . .

MORE HEAT TREATING CAPACITY per DOLLAR

The relatively simple design and construction of the AGF Rotary Carburizer enables you to purchase more heat treating furnace capacity per dollar expended than can be obtained with any other type of furnace.

"POINT OF CONTACT" CASE VARIATIONS are ELIMINATED

Gentle tumbling of the work as the retort rotates, eliminates "point of contact" case variations which can occur in furnaces when parts remain stationary. Every single piece is uniformly heated and exposed to the action of the atmosphere gas.



A battery of AGF No. 4 Rotary Retort Carburizers in use at the Timken plant, where AGF furnaces have been used more than 32 years.

Versatility Increased

The AGF Rotary Carburizer is a versatile batch type furnace that can quickly convert from one process to another for different work charges. Clean hardening, annealing, normalizing, etc., can be accomplished without any modifications to the furnace.

"PIONEER builders of heat treating and industrial gas equipment since 1878".

80 YEARS OF PIONEERING 1878 1958

☐ Send me full information about AGF Carburizers.
☐ Have a factory trained engineer call on me.

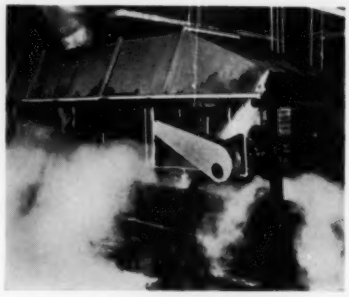
My Name ..... My Title .....
My Company .....
Street Address .....
City ..... State .....

AMERICAN GAS FURNACE CO.
808 LAFAYETTE STREET — ELIZABETH 4, N. J.
"Pioneers since 1878"

NEWS TO HEAT TREATERS

(Continued from page 24)

oxide systems provide round-the-clock protection against such blazes. At the first flick of flame, rate-of-temperature-rise fire detectors (or in some cases, fixed temperature thermostats) trigger nearby cylinders of carbon dioxide. The pressurized gas floods from its containers and passes to the tank where it is discharged from Multijet nozzles across the surface of the flaming oil in sufficient volume to reduce oxygen to a degree insufficient to support combustion. The fire is snuffed out in seconds. In addition, the cooling action of the dry ice gas tends to lower oil temperature, minimizing the possibility of a re-flash.



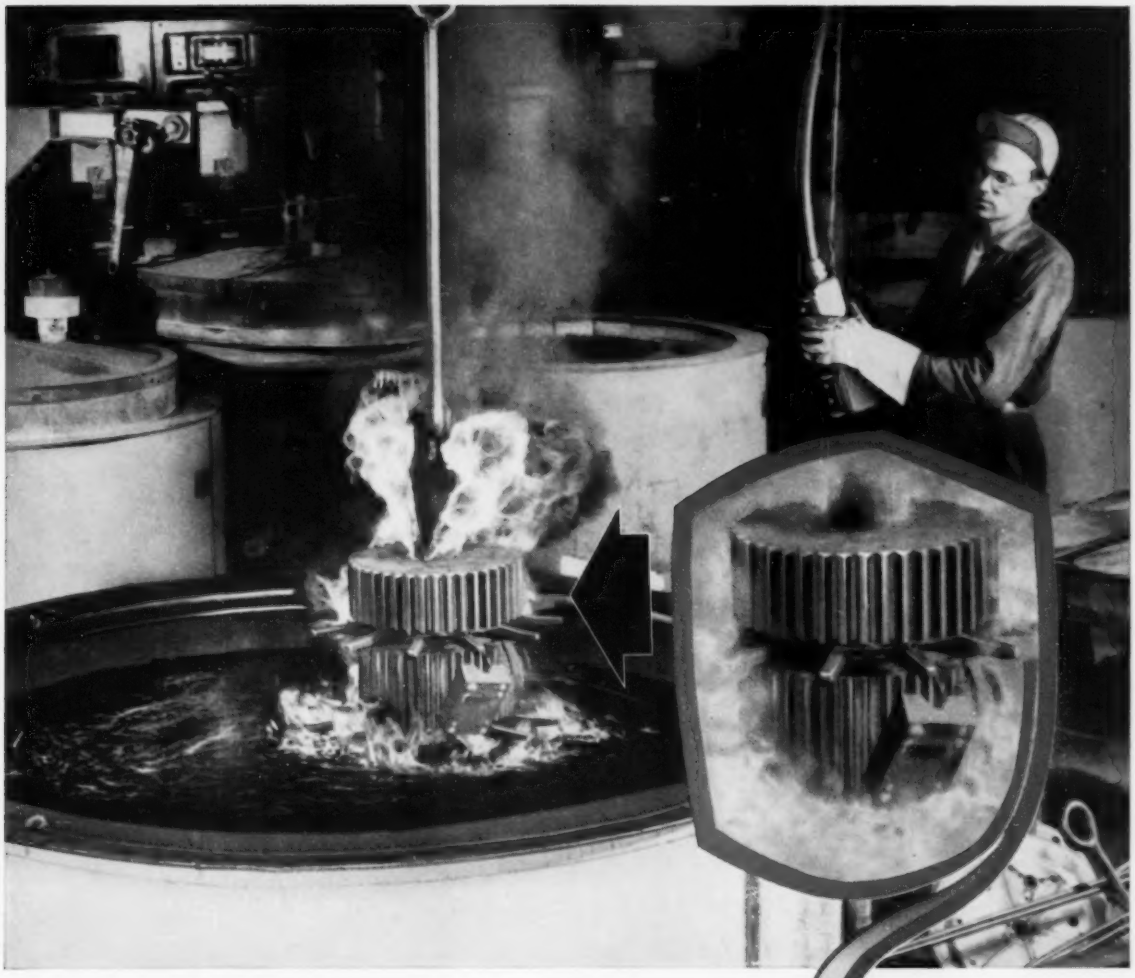
For further information circle No. 8

STRAIGHTENING PRESS

A new line of Flexible-Power straightening presses for both high-production operations and small shops has been announced by General Manufacturing Co., Detroit.

Precision-built for hot or cold straightening operations, the low-cost presses feature a pneumatic-mechanical operating principle to bring a new measure of sensitivity to press operation.

(Continued on page 30)



Pierce the Vapor Blanket Fast

with Cities Service QT-3

Speeds Initial Hardening Stages... Slows Final Cooling for "Machine Shop Tolerances"

Now... an oil that gives exceptionally fast quenching in the critical hardening stages and yet slows cooling in the final stage to eliminate cracking and give "machine shop tolerances" to even the most complicated shapes.

Cities Service QT-3 contains a special wetting additive that breaks through the vapor blanket to give a fast, yet controlled quench.

QT oils also contain an anti-oxidant that prevents sludge... keeps circulating systems operating at top efficiency and enables the oil to be used indefinitely with minimum make-up oil added.

Contact your local Cities Service office for detailed information on QT oils that can give you exceptional hardness with a minimum of distortion and yet save you money due to their stability and long life... or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

YOU CAN FIND BOTH THE BIGGEST AND THE BEST AT YOUR COMMERCIAL HEAT TREATER

A new gas fired Homocarb said to be the world's largest.

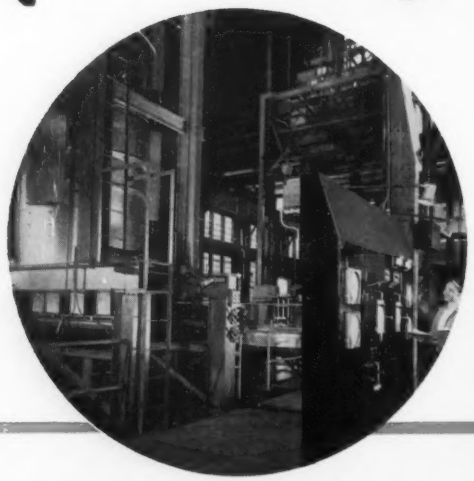
THE THREE FURNACES shown on this page are units of the facilities of three commercial heat treating plants in different sections of the country.

Today, with the ever growing demand for *better* heat treating, economical volume equipment of this sort is becoming essential and the commercial heat treater has been alert to industry's requirements.

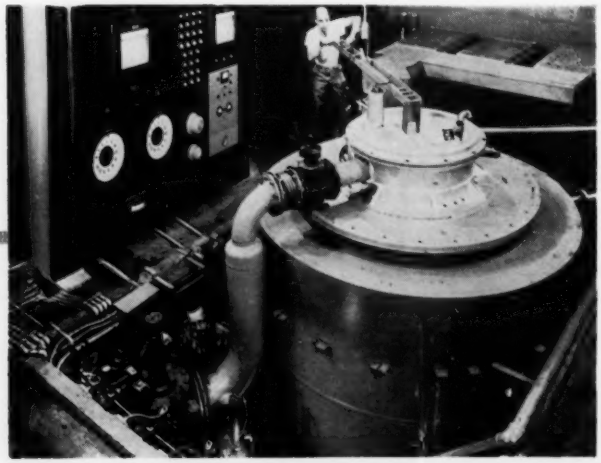
Quality work and versatility are the keynotes of this industry's objectives when treating the thousands of vital, intricate, and costly components of important products.

Whatever your heat treating problem, and whether it involves pounds or tons, always consult your *commercial* plant first.

Write for the folder
"HEAT TREATERS CITE SHORT CUTS TO MORE EFFECTIVE PURCHASING."



Large capacity vertical furnace for heat treating large parts.



A Vacuum Heat Treating Furnace for special materials.

THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

CALIFORNIA

Certified Steel Treating Co.
2454 E. 58th St., Los Angeles 58
Hollywood Heat Treating Co.
1041 N. Mansfield Ave., Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 12

ILLINOIS

Senecca Heat Treating Co.
124 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Allied Metal Treating Corp. of Illinois
333 N. California Ave., Chicago 12
Dura-Hard Steel Treating Co.
2112 W. Rice Street, Chicago 22
Pearson Steel Treating Co.
5757 W. Odgen Ave., Cicero 50
Perfection Tool & Metal Heat Treating Co.
1756 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kinzie St., Chicago 22
American Steel Treating Co.
P. O. Box 225, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Loves Park, Rockford
Lindberg Steel Treating Co.
1975 N. Ruby St., Melrose Park
Ipsenlab of Rockford, Inc.
2125 Kishwaukee Street, Rockford
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford
C. U. Scott & Son, Inc.
1510 First Ave., Rock Island

INDIANA

Quality Steel Treating Company
1630 Locust Street, Anderson

MASSACHUSETTS

Kinetics Corporation
2 Churchill Road, Hingham
New England Metallurgical Corp.
475 Dorchester Ave., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
1033 Mt. Elliot Ave., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Standard Steel Treating Co.
3467 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
Lincoln Heat Treat, Inc.
21235 John R, Hazel Park
Metallurgical Processing Company
2703 East Nine Mile Road, Warren
Royal Oak Heat Treat, Inc.
21419 Dequindre, Hazel Park
American Metal Processing Co.
12000 East Nine Mile Road, Van Dyke

MINNESOTA

Metallurgical, Inc.
900 East Hennepin, Minneapolis 14

MISSOURI

Metallurgical, Inc.
1727 Manchester Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Metal Treating Corp.
611 Grove St., Elizabeth 2
American Metal Treatment Co.
Spring and Lafayette Sts., Elizabeth
Benedict-Miller, Inc.
Marin Ave. & Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark 5
Temperature Processing Co., Inc.
228 River Road, North Arlington

NEW YORK

Owego Heat Treat, Inc.
Rural Route 1, Apalachin
Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E. Rochester 5
General Heat Treating Corporation
206 Sand Street, Syracuse 3
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 11
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Dresher
J. W. Rex Co.
834 West 3rd St., Lansdale
Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 E. Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
Gulph Road, King of Prussia
Pittsburgh Commercial Heat Treating Co.
49th St., and A.V.R.R., Pittsburgh 1
Pittsburgh Metal Processing Co., Inc.
1850 Chapman Street, Pittsburgh 15

TEXAS

Dominy Heat Treating Corp.
P. O. Box 5054, Dallas
Superior Heat Treating Co., Inc.
P. O. Box 169, Fort Worth 1
United Heat Treating Company
2005 Montgomery Street, Fort Worth 7
Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11
Houston Heat Treating Company, Inc.
2100 Quitman Street, Houston 26
Lone Star Heat Treating Corp.
5212 Clinton Dr., Houston 20

WISCONSIN

Allied Metal Treating Corp.
P.O. Box 612, Milwaukee 1
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wisconsin Steel Treating & Blasting Co.
1114 South 41st Street, Milwaukee 15
Harris Metals Treating Co.
4100 Douglas Ave., Racine

CANADA

Ipsenlab of Canada Limited
27 Bermondsey Road, Toronto 16, Ont.

METAL TREATING INSTITUTE

271 NORTH AVENUE, NEW ROCHELLE, N. Y.

NEWS TO HEAT TREATERS

(Continued from page 26)

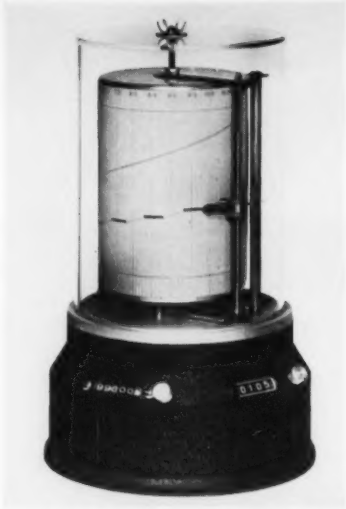
Sensitivity is maintained from the slowest ram movement to snap action, even at maximum press power. The operator can deflect the work a few thousandths at a time, controlling each movement through a constant-contact underside gage. Available in single-ram models or three, four or five-ram multiple head models with fully adjustable outside head positions, Flexible-Power presses range from five to 20-ton capacity. Hand or foot controls are optional.

For further information circle No. 9

EFFICIENCY RECORDER

The Efficiency Recorder (time utilization), made by Gorrell & Gorrell is of interest to the management of metal treating plants. It provides a maximum amount of information in a single line to give quick reading and complete understanding without further study or analysis. It is quickly attached to machines and processes, especially ovens, furnaces and baths.

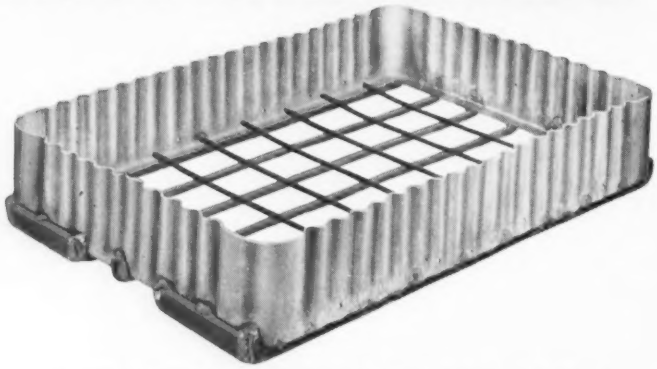
The Efficiency Recorder produces a single line, automatically, continuously and precisely by an inkless stylus on a waterproof chart. This one line shows: (1) Operating as well as "down" time . . . when it occurred . . . and for how long; also (2) A graphic pattern of use or activity throughout the entire shift; and (3) A graphic representation of average percentage (efficiency) of ON time, minute by minute.



In the photo is an accessory, the sub-base with the two resetable figures. One shows to the nearest second the ON time. The other shows the number of operating cycles for easy read-out. An option feature is the line intensifier which makes the horizontal portion of the line (down time) very conspicuous.

For further information circle No. 10

Fabricated Heat and Corrosion Resisting Alloy Steel Boxes, Baskets, Fixtures and Retorts



Corrugated Alloy Boxes, Baskets and Retorts have increased the Service Life of Alloy Steel Fabrications used in the Heat Treating Industry and have proven to be economical.

We will cooperate with your Engineering Organization in designing your alloy steel and non-ferrous metal fabrications.

We have facilities to form ⅝" thick by 10 ft. long steel plate in our 500-ton Press Brake. We can form heavier plate in shorter lengths. We also have facilities for roll forming heavy and thin wall cylinders or tubes to almost any diameter you specify.

Repeat purchase by prominent Heat Treaters is their endorsement of the superior performance and economy of our alloy metal fabrications.

We have 25 years experience fabricating for the Heat Treating Industry and corrosion resisting metals for the chemical and processing industries.

We solicit your inquiries for Boxes, Baskets, Trays, Radiant Tubes, Fixtures and Retorts, etc.

For further information send for our literature.

ALUMINUM and ARCHITECTURAL METALS COMPANY

Heat Treating and Industrial Processing Accessories Division

1974 Franklin Street • Detroit 7, Michigan • LOrain 7-6880

AUTOMATIC KNIFE-BLADE HARDENING MACHINE

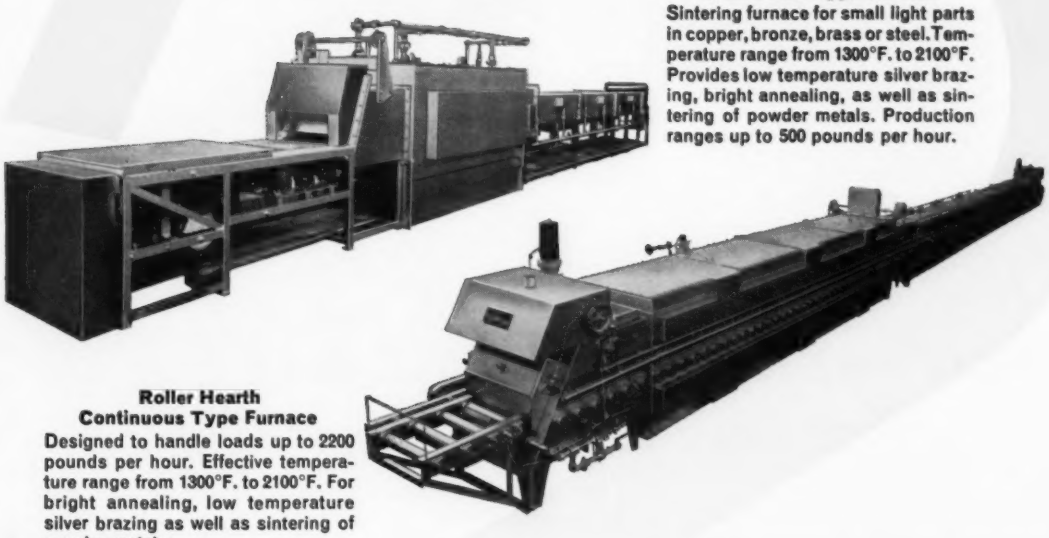
An automatic gas-fired furnace, designed and built by Selas Corporation of America, has eliminated hazardous and costly molten lead

(Continued on page 34)

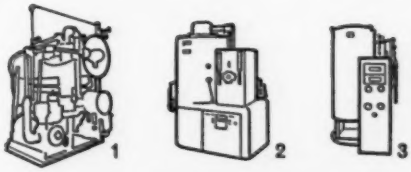
Look to Lindberg for sintering furnaces

Hand Pusher Batch Type Furnace
For small production lots and experimental sintering. An all-purpose unit for operation from 1300° F. to 2500° F. Made in various sizes for sintering from 25 to 300 pounds per hour.

Mesh Belt Continuous Type Furnace
Sintering furnace for small light parts in copper, bronze, brass or steel. Temperature range from 1300°F. to 2100°F. Provides low temperature silver brazing, bright annealing, as well as sintering of powder metals. Production ranges up to 500 pounds per hour.



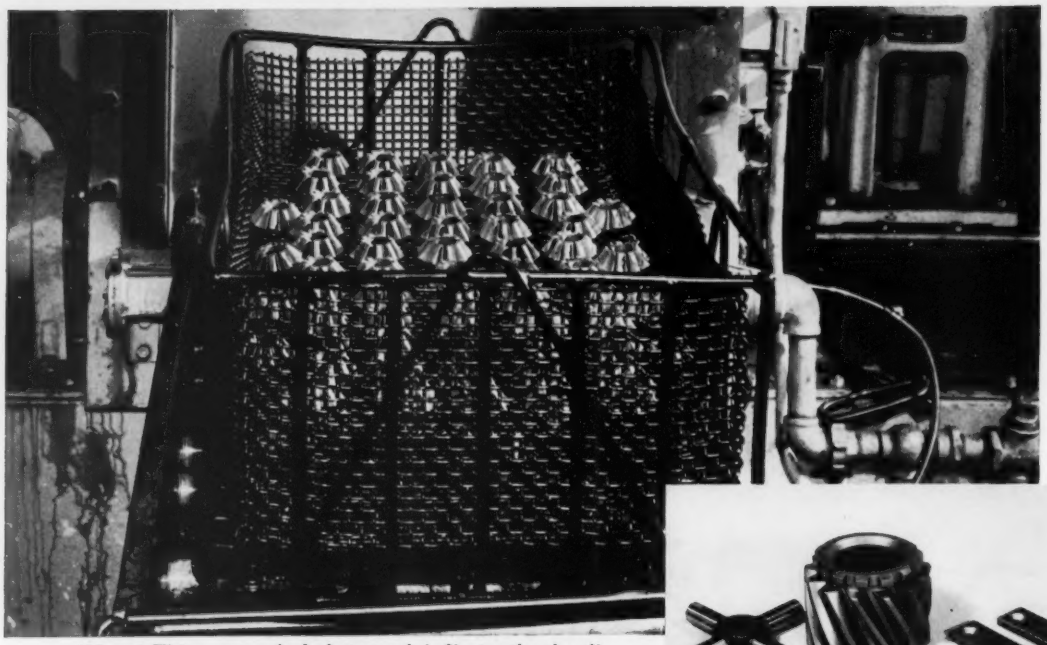
Roller Hearth Continuous Type Furnace
Designed to handle loads up to 2200 pounds per hour. Effective temperature range from 1300°F. to 2100°F. For bright annealing, low temperature silver brazing as well as sintering of powder metals.



Lindberg atmosphere generators provide the proper atmospheres recommended for use with Lindberg Sintering Furnaces. These are: 1. HYEX Generator... approximately 4% carbon dioxide—18% hydrogen—12% carbon monoxide and 66% nitrogen. 2. HYEN Generator... neutral atmosphere approximately 21% carbon monoxide—40% hydrogen—38% nitrogen and 1% methane. 3. HYAM Generator... composed of approximately 75% hydrogen and 25% nitrogen.

For sintering furnaces, just as in all types of industrial heating equipment, you can depend on Lindberg's ability to supply exactly the right equipment for your needs. Just get in touch with your nearest Lindberg Field Representative, or write Lindberg Engineering Company, 2466 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California.

LINDBERG heat for industry



(Above) This unretouched photograph indicates the cleanliness of rear axle differential pinions when Voluta Oil is used. (Right) Differential spider, two-speed helical pinion and spring wear plates were all quenched with Shell Voluta Oil.

Here's a stable, high-speed quenching oil that minimizes work distortion

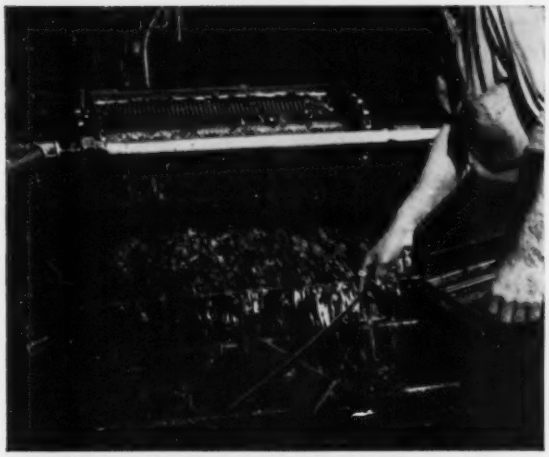
There has long been an urgent need for a uniformly stable quenching oil that would perform satisfactorily with minimum distortion of the workpiece. During the quenching operation, fluid deterioration can occur, causing sludge and acid formations which in turn result in non-uniform physical characteristics of quenched parts.

An efficient and timely answer to this industry problem is found in Shell Voluta Oils. They satisfy the two basic requirements of a high-quality quenching oil: 1) They remain stable at temperatures much higher than heretofore allowable, with no appreciable sludge formation. 2) They permit safe, rapid quenching of parts which have a tendency to distort. This is in part due to the higher permissible fluid temperatures, and also to the greatly enhanced wetting qualities of Voluta* Oils.

There are many applications that clearly demonstrate the efficiency and versatility of Voluta Oils.

One example relates to a leading producer of several thousand varieties of axle parts. With conventional quench oils, rejects were high due to unfavorable stress concentration and subsequent cracking. After changing to Voluta Oil, maximum uniformity was achieved because of Voluta's superior wetting-out properties and stable cooling rate. For heat-treating purposes, Voluta Oils proved stable at temperatures from 130° to 200° F. They also provided greater surface hardness, depth of hardness and uniformity.

A well-known manufacturer of automotive steering units was faced with a similar situation. Here the problem involved heat-treating low-carbon-steel parts as well as grey-iron castings. Although they were of widely varying materials, shapes and sizes, this company found that



Shaker hearth furnace automatically dumps parts into Shell Voluta Oil, then removes and drains them.

Over 35,000 prints of production items like these (quenched in Voluta Oil) are kept on file by one leading steel spring manufacturer.

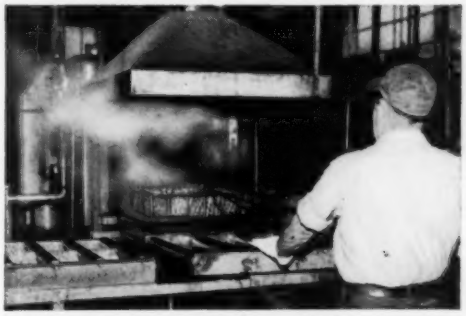
Voluta Oil was far superior in all these ways: 1) longer life; 2) clean, scale-free parts; 3) wider range of quench temperatures; 4) no rejects due to distortion; 5) no sludge formation.

Still another case occurred during the manufacture of many thousands of different shaped springs. This company wanted to insure maximum elasticity of their springs, and to achieve this a 100 per cent martensitic structure had to be maintained. Tested in competition with several other quench oils, Shell Voluta Oil again proved superior because it resulted in the production of distortion-free springs, and allowed quicker drainage and minimum dragout loss.

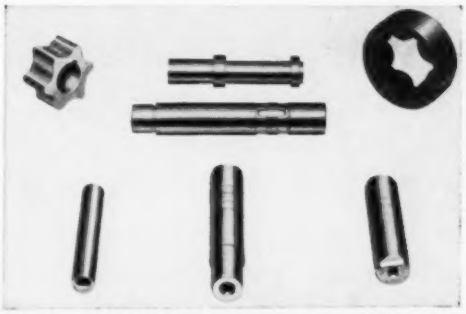
Another feature: Voluta affords substantial savings on a yearly basis . . . and it further proves its economy in reduction of rejected parts.

Perhaps you have a similar quench problem . . . or any quench problem, for that matter. It would be to your advantage to call or write your nearest Shell Oil office. We'd be glad to have our representative discuss your particular quench problem and methods to help overcome it.

*Registered Trademark



Parts are heat-treated and quenched in two-zone hardening furnace while Voluta Oil's temperature is closely controlled.



Castings and low-carbon-steel parts for hydraulic steering units are all processed through the same heat-treating furnaces and quench tanks.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

NEWS TO HEAT TREATERS

(Continued from page 30)

baths in hardening the blades of stainless steel table knives in a prominent eastern silverware plant.

Knives from 7 to 8-7/8 in. long (approximately 3½ in. handle) are heat treated at a rate of 1500 blades per hr. by one operator in this compact unit, which occupies only 9 ft. by 3⅝ ft. of floor space. The blade is uniformly hardened to Rc 42/44, while the handle retains full softness (Rc 0/10).

Knives are loaded by hand and carried blade-up through the Gradiation furnace, where the blades are quickly brought to 1950°F without scale formation. They are then carried through a short air-cooling zone and automatically discharged into collecting baskets.

For further information circle No. 11

INDUCTION HEATING GENERATOR

The addition of a Dual Frequency Generator to its line of High Frequency Induction Heating Units has been announced by Lepel High Frequency Laboratories, Inc. of Woodside, N. Y. This generator is rated at 10 KW of output power. The lower frequency range is 250 to 600 Kc. The higher frequency range is approximately 2 to 5 megacycles. It provides flexibility in heating operations where frequency may be important without changing the basic features

of the standard generator and also eliminates the necessity of purchasing two separate generators. Megacycle frequencies are ideal for heating very thin parts, semiconductor materials and superficial heating.

For further information circle No. 12

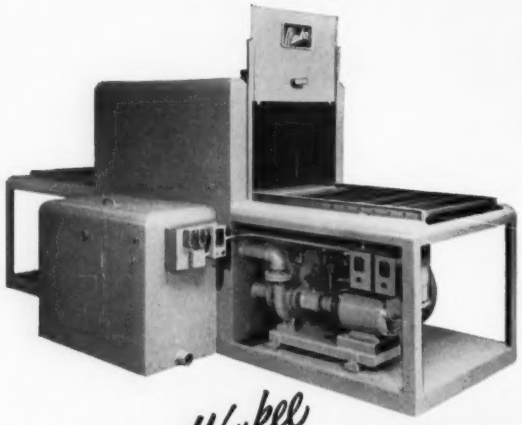
NEW APPOINTMENTS

Heatbath Corporation announces the appointment of Pete Petroff as sales representative in Western Ohio, Southern Indiana and Northern Kentucky.

Mr. Petroff is a graduate of Ohio State University and was formerly associated with the Bison Corporation of Canton, Ohio. He will handle Heatbath's complete line of metal finishing and heat treating products and will have headquarters in Columbus, Ohio.

Heatbath also announces the transfer of Jim Wheeler to the Chicago district where he will assume new sales duties. Mr. Wheeler will continue to supervise sales in the area covered by Mr. Petroff as well as in the Cleveland area.

(Continued on page 36)



There's a standard Waukee® WASHER
TO MATCH YOUR CARBONITRIDER OR CARBURIZER!

Whatever the size of your carbonitrider or carburizer, the new Waukee Washer has a standard size to match it. Size range: 24 x 36 x 18 — 24 x 48 x 24 — 30 x 48 x 24 — 36 x 48 x 24.

COMPLETE — NO "EXTRAS" — Waukee parts washers come to you complete, ready to locate, connect to utilities, and begin operation. No "extras" to buy and install. Pumps, burners, controls are designed as integral parts of the Waukee Washer. You use your present furnace work-baskets, too.

FLEXIBILITY — You gain in flexibility with Waukee Washers. Standard units are available in "in-and-out" feed or straight-through, conveyor type, and in one, two, or three stages with rinse and dry. High-efficiency with gas, electricity, or steam.

THOROUGH CLEANING — The smallest Waukee Washer sprays a minimum of *one ton of hot detergent solution through the load each minute*. Solution penetrates work basket from top and bottom, washes away oil and foreign matter from the densest charge. Bull's-eye timer cycles the load for complete washing without guesswork or waste of time.

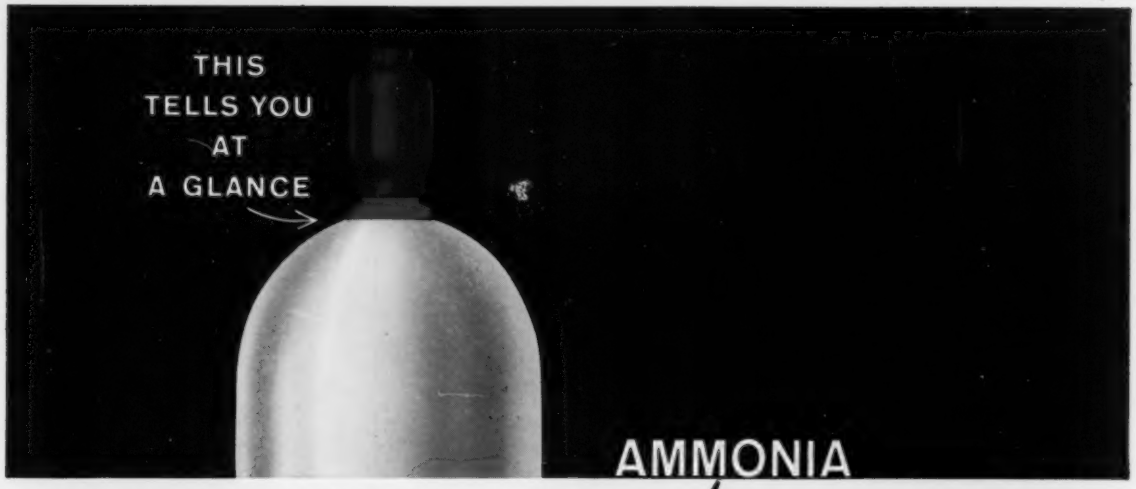
Complete data in Bulletin 1201 — write for it today.

Waukee-washed parts are free of cutting and quenching oils, mean clean furnace atmospheres, therefore predictable case depths and cleaner, brighter work.

Waukee ENGINEERING CO.

5137 N. 35TH ST., MILWAUKEE 9, WIS.

MAKERS OF WAUKEE GAS FLO-METERS • MIXORS • COMPRESSORS



IT'S THE PUREST, DRIEST / YOU CAN BUY

This blue neck on the cylinder is all you need to know about ammonia to be sure it will give trouble-free service in your dissociator.

The blue band identifies Allied Chemical's BARRETT BRAND Anhydrous Ammonia – the purest, driest you can buy. Then, to make sure it's delivered to you as pure as it's made, blue neck cylinders get V.I.P. treatment at Allied: they're reserved for metal treating service only, and every precaution is taken to make sure they're free from oil or other contaminants.

Order Barrett Brand Ammonia from any of these Allied distributors:

ARKANSAS
Little Rock: Terminal Warehouse Co., 500 E. Markham St.
Thompson-Hayward Chemical Co., 3100 W. 65th St.

COLORADO
Denver: Mine & Smelter Supply Co., 3800 Race St., P.O. Box 5041

CONNECTICUT
West Hartford: The Christian Petersen & Son Co., 26 Brook St., P.O. Box 247

FLORIDA
Jacksonville: D. W. Anderson, 615 E. Bay St., P.O. Box 1346
Miami: Columbia Chemical & Supply Co., 7430 N.E. 4th Ct., Box 967
L.R. Station
Tampa: Food Equipment & Supply Co., Inc., 1809 Second Ave., P.O. Box 422

GEORGIA
Atlanta: Atlanta Nitrogen Division, Allied Chemical & Dye Corp., 127 Peachtree Street, N.E.
Macon: The Anderson Chemical Co., Inc., 1620 Waterville Rd., P.O. Box 1424
Savannah: J. C. Warehouse & Transfer Co., Louisville Rd., P.O. Box 2069

ILLINOIS
Centralia: Kem-I-Kal Engineering Laboratories, Inc., Pearcy & Broadway
Chicago: Barrett Div., Allied Chemical & Dye Corp., 2800 So. Sacramento Ave.
Westland Engineering Supply Co., 53 W. Jackson Blvd.

INDIANA
South Bend: Mid-Continent Chemicals, Inc., 2217 So. Main St.

IOWA
Burlington: McKesson & Robbins, Inc., 100 N. 4th St., P.O. Box 591
Cedar Rapids: McKesson & Robbins, Inc., 900 2nd St., S. E.
Davenport: Roederer Transfer & Storage Co., 513 Filmore St.
Des Moines: Blue Line Storage Co., 226 Elm St.
Ottumwa: J. W. Edgerly & Co., 120 W. Main St.
Sioux City: McKesson & Robbins, Inc., 308 Pearl St.

KANSAS
Wichita: Reid Supply Co., 306 W. 2nd St.

KENTUCKY
Henderson: P. B. & S. Chemical Co.,
1109 N. Adams St.
Louisville: Griffin Chemical Co., 528 Franklin St.

LOUISIANA
New Orleans: Joseph Jurisich Warehouse, 338 No. Peters St.
Sam Reisfeld & Son, 649 So. Galvez St.
Shreveport: Thompson-Hayward Chemical Co., 219 Beech St.

MAINE
Portland: Acme Engineering Co., 46 Market St.

MARYLAND
Baltimore: Leidy Chemicals Corp., 920 S. Eutaw St.

MASSACHUSETTS
Attleboro: Reynolds & Markman, Inc., 88 Union St.
Malden: Barrett Div., Allied Chemical & Dye Corp., 378 Commercial St.
Springfield: The Chemical Corp., 54 Waltham Ave.
West Springfield: Barker Chemical Co., 101 Circuit Ave., P.O. Box 173
Worcester: Brewer & Company, Inc., Ind. Chem. Div., 45 Arctic St.
Chemical Sales & Service Co., Inc., 45-61 Fremont St.

MICHIGAN
Detroit: Barrett Div., Allied Chemical & Dye Corp., 1200 Zug Island Rd.
Eaton Chemical & Dyestuff Co., 1430 Franklin St.

MINNESOTA
Duluth: Northern Cold Storage & Warehouse Co.
St. Paul: Lyon Chemicals, Inc., 2305 Hampden Ave.

MISSISSIPPI
Jackson: Ricks Storage Co., 126 Ricks St.

MISSOURI
Joplin: P. G. Walker & Son, Inc., 702 Pennsylvania Ave.
Kansas City: Abner Hood Chemical Co., 307-317 N. Montgall Ave.
Thompson-Hayward Chemical Co., 2915 Southwest Blvd.
Springfield: P. G. Walker & Son, Inc., 1435 College St.
St. Louis: McKesson & Robbins, Inc., 904 Landreth Bldg., 320 No. Fourth St.
Nitrogen Div., Allied Chemical & Dye Corp., 4528 South Broadway
G. S. Robins & Co., 126 Chouteau Ave.

NEBRASKA
Omaha: McKesson & Robbins, Inc., 902 Farnam St.

NEW JERSEY
Edgewater: Nitrogen Div., Allied Chemical & Dye Corp., 1 River Rd.
Paterson: Lotte Chemical Corp., 109 - 5th Ave., P.O. Box 2488
Seaboard Industries, 195 Keen St.

NEW YORK
Albany: Albany Laboratories, Inc., 67 Howard St.
Brooklyn: Engel's Trucking Co., 541 Kent Ave.
Tex-Ite Products Corp., 535 Park Ave.
Buffalo: Commercial Chemicals, Inc., 241 Hertel Ave.
East Syracuse: Gleason Chemical & Supply Co., Inc., 130 Headson Drive
New York: Davies Nitrate Co., 114 Liberty St.
N. H. Heyman, Inc., 168 East 91st St.
Nitrogen Div., Allied Chemical & Dye Corp., 40 Rector St.
E. M. Sargent Pulp & Chemical Co., Inc., 7 Dey St.
Poughkeepsie: Duso Chemical Co., Inc., Fulton & Fairview Sts., P.O. Box 665
Rochester: William B. Duffy Carting Co., 62 Scio St.

NORTH CAROLINA
Charlotte: Acme Soap & Chemical Co., Inc., Pineville Rd., P.O. Box 11,264

OHIO
Cincinnati: Merchants Chemical Co., Inc., 2933 Spring Grove Ave.
Cleveland: The Conaty Warehouse Co., 1245 Hemlock St.
The Harshaw Chemical Co., 1945 E. 97th St.
Columbus: Merchants Chemical Co., Inc., 1795 South High St.
Toledo: Inland Chemical & Solvent Corp., 1175 Dorr St.

OKLAHOMA
Oklahoma City: Rex Engineering & Sales Co., 2735 N.W. 10th St., P.O. Box 5141
Tulsa: Vaughn Chemical Co., 1102 E. 3rd St.

PENNSYLVANIA
Altoona: Western Pennsylvania Chemical Co., Inc., 4125-41 6th Ave., P.O. Box 763
Avoca: Lunox Chemical Works, Inc., Box 7
Erie: Western Pennsylvania Chemical Co., Inc., 2001 W. 12th St.
Middletown: Western Pennsylvania Chemical Co., Inc., Brown & Catherine Sts.
Philadelphia: Barrett Div., Allied Chemical & Dye Corp., 36th St. & Gray's Ferry Rd.
Hugh F. Gannon Trucking Corp., 450 N. Front
Pittsburgh: Thomas Kisch, 244 Bascom St.
Pitt-Penn Terminal Co., 1320 Penn Ave.

RHODE ISLAND
Providence: T. H. Baylis Co., 42 Gano St.

SOUTH CAROLINA
Charleston: Thomas W. Carroll, Inc., 24 Market St.

TENNESSEE
Memphis: The Lilly Co., 466 Union Ave.
Nashville: Cumberland Storage & Whse. Co., 124 1st Ave., N.

TEXAS
Big Spring: T & T Supply Co., Inc., 1308 E. 3rd St.
Dallas: Alford Refrigerated Warehouse, 318 Cadiz St., P.O. Box 5088
Chas. H. Platter & Co., Texas Bank Bldg., P.O. Box 5998
El Paso: George S. Thompson Co., Inc., 611-615 No. Campbell St.
Harlingen: Jones Moving & Storage Co., 1002 W. Jackson
Houston: Leatherwood Supply Co., 2005 McKinney
Lubbock: Thompson-Hayward Chemical Co., P.O. Box 323
San Antonio: Ryan Brokerage Co., Transit Tower
Scobey Fireproof Storage Co., 315 N. Medina

VERMONT
Burlington: Valcour Chemical Co., Inc., Ft. Sts. Champlain St.

VIRGINIA
Richmond: Phipps & Bird, Inc., 302 South 6th St., P.O. Box 2-V

WEST VIRGINIA
Charleston: B. Preiser Co., Inc., 416 W. Washington St., P.O. Box 6118

WISCONSIN
Chippewa Falls: Lyon Chemicals, Inc., 201 E. Walnut St.
Cottage Grove: North Central Chemicals, Inc.
Green Bay: Wisconsin Refrigeration Supply Co., 1016 Velp Ave.
Milwaukee: Benio Chemicals, 1907 - 25 South 89th St.

Allied Chemical

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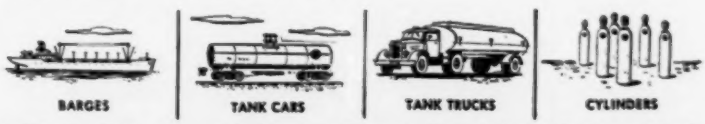

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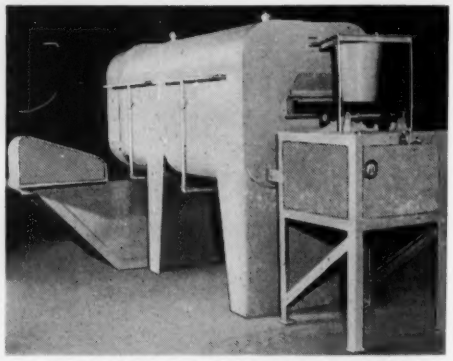

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Your production requirements will probably fit a STANDARD DFC SHAKER for HARDENING — NITRIDING — CARBONITRIDING — CARBURIZING

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11B2	125 - 175 lbs. per hr.
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Automatic Loaders and Automatic Conveyor Quench Equipment are available for all capacities.

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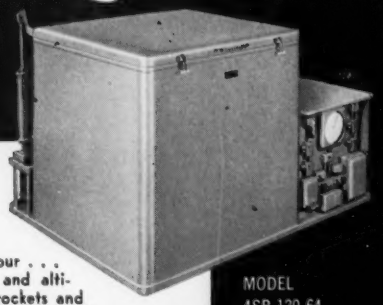
must be more than skin deep!



Cincinnati Sub-Zero insures maximum stability of metals even at supersonic speeds!

Speeds of thousands of miles per hour . . . murderous split-second temperature and altitude changes . . . today's aircraft, rockets and missiles survive an almost unbelievable assault in the vital race for preparedness.

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Member, Environmental Equipment Institute

NEWS TO HEAT TREATERS

(Continued from page 34)

FURNACE RETORTS

The Stanwood Corporation, Chicago, has introduced a new line of furnace retorts. These retorts, furnished in the new Cor-Wal construction, are available in all standard sizes. This construction, a Stanwood development, consists of heat resistant corrugated rolled metal sides with a one-piece cast, reinforced top seal. A specially developed technique is used in welding the various parts of the retort as a unit.

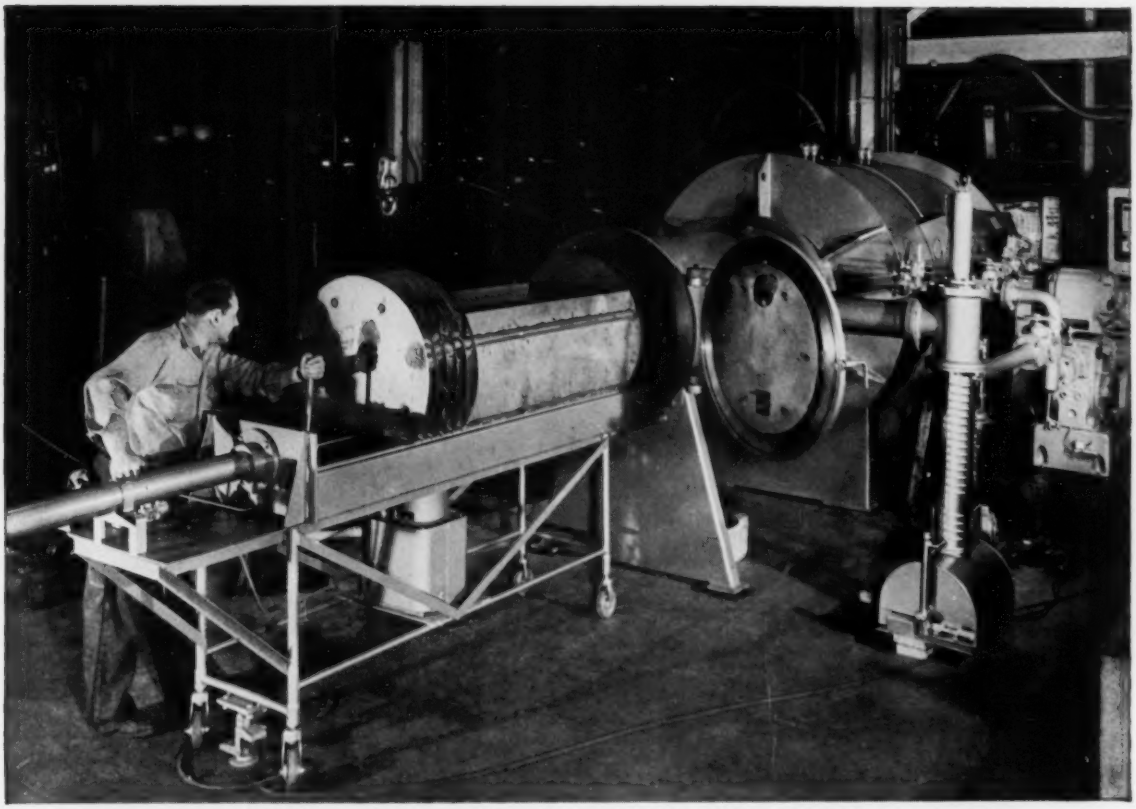
It is claimed that the new design of this retort provides a lighter weight yet stronger construction. The vertically corrugated sections greatly increase the side wall strength of the retorts. The increased surface area provided by the corrugating process results in more efficient heat transfer.

For further information circle No. 13

SALES AGENT

Mr. E. J. Funk, vice president of the C. M. Kemp Manufacturing Company, has announced the appointment of Jobe & Company as the exclusive sales agent for Kemp equipment for Maryland, Virginia and the District of Columbia. Jobe & Company has offices in Baltimore, Richmond and Washington, D. C.

(Continued on page 38)



Loading Zone. Hydraulic ram drives movable work boat into the two-temperature-zone vacuum chamber of new Stokes furnace equipped with Inconel nickel-chromium alloy retort at the Martin Company plant, Baltimore. Suitable for vacuum brazing, annealing and degassing, the electric alloy heated unit can maintain operating temperatures over 2000°F at pressures as low as .2 microns.

Designers equip new Stokes vacuum furnaces with Inconel retorts for Martin experiments

Horizontal retort vacuum furnaces come *bigger* these days.

And *better*, too! Among other reasons, because designers and builders are standardizing on retorts of Inconel* nickel-chromium alloy . . .

Typical of this trend is the furnace shown here. It was designed and built by the Vacuum Equipment Division of F. J. STOKES CORPORATION, Philadelphia, Pa. The unit is one of two identical furnaces in operation at THE MARTIN COMPANY, Baltimore, Md.

Right now, Martin uses them mostly for experimental and limited-scale production vacuum brazing of aircraft components. But if they wish, they can easily switch to vacuum de-gassing, annealing or other heat treating operations.

The furnace structure, supplied by LINDBERG ENGINEERING COMPANY, Chicago, Ill., has a refractory-lined outer wall. In use, the space between the vacuum retort wall and the outer furnace shell is evacuated to approximately 500 microns. This reduces external forces on the Inconel alloy retort where pressures inside the retort drop to as low as .2 microns at temperatures in excess of 2000°F.

Retort material must have the strength to hold long-continued high vacuum at heat . . . resist thermal shock from rapid cooling . . . withstand corrosive atmospheres. *Inconel alloy does all these things.* And does them well!

In addition, it simplifies furnace construction. Its good "hot strength" helps in practical design. And Inconel alloy can be readily worked and welded to give a strong vacuum-tight joint that *stays* gas-tight.

For information on the use of Inconel alloy in heat treating equipment, write Inco for our informative booklet, *"Keep Operating Cost Down When Temperatures Go Up . . ."*

*Registered trademark

The INTERNATIONAL NICKEL CO., Inc.

67 Wall Street INCO New York 5, N. Y.

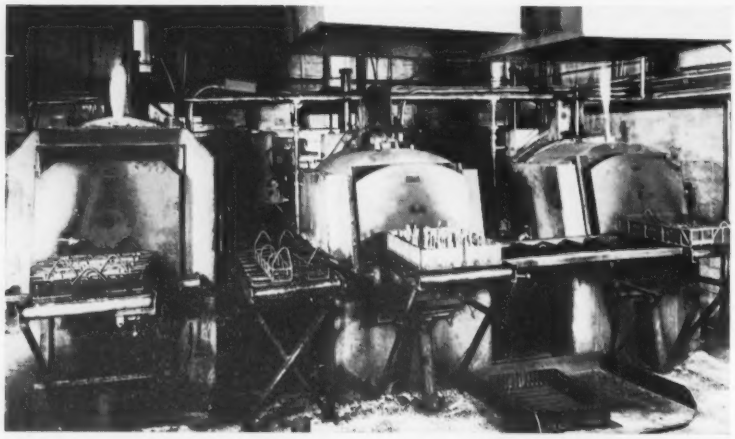
INCO NICKEL ALLOYS

NEWS TO HEAT TREATERS

(Continued from page 36)

ALLOY FOR BASKETS AND FIXTURES

The Heat Treating and Industrial Processing Accessories Division, of The Aluminum and Architectural Metals Company, Detroit, Michigan, made the claim that as a result of exhaustive tests, using most alloys known and available to the Heat Treating Industry, that



RA 330 alloy made by Rolled Alloys, Inc. was one of the finest alloys available for the heat treating industry.

Several months ago they met the challenge of developing a basket design, with inserts for fixturing different types of work, for one of the toughest applications. Their goal was to find a design and an alloy that would be strong; that would resist Carburizing and Carbo-Nitriding atmospheres followed by direct oil quench; that would provide good, sound welded joints; that would accommodate a variety of work; and would stand-up under a 6-day, 24 hours a day, type of operation.

The Aluminum and Architectural Metals Company found that baskets and inserts made with RA-330 alloy, and welded with RA-330-80 electrodes, would last longer than any other type fabricated—up to 6 months longer. Furthermore, after months of steady use, the welds were sound, and distortion was so slight, that they never needed repairs or straightening. Baskets made from other alloys warped, and had to be straightened, or repaired frequently.

They discovered other advantages using RA330 alloy;—that it was easier to get liners in and out of the bar type baskets; that basket weight could be reduced because of the higher strength of RA330, making them much lighter to handle, and less expensive to fabricate; and, that they did not break as easily.

Shown in the accompanying photograph are some typical applications of RA330 alloy. There you see baskets and fixtures for carburizing and carbo-nitriding with direct quench from 3 batch-type, controlled atmosphere furnaces — tractor parts, airplane parts and automotive parts. These baskets are capable of handling the variety of parts in a typical commercial heat treat shop, with net loads ranging from 10 pounds to 500 pounds.

These tests proved conclusively that both bar type and corrugated type baskets, as well as fixtures, made from RA330 alloy will stand up under temperature ranges from 1500°F to 1800°F in destructive atmospheres with direct quench 6 days a week, and 24 hours a day, and still give longer life than any other alloy previously used. Corrugated baskets in another plant have been in this type of service for a year and a half.

For further information circle No. 14

Sound Familiar?
EXPENSIVE EQUIPMENT
FLOORSPACE PROBLEMS
HEAT COSTS
BIGGER PAYROLL
INSURANCE COSTS
HERE'S A GENT IN GREAT TORMENT,
HE GAVE METAL PARTS HOME TREATMENT
BEFORE HE RID HIS PLANT OF VEX AND WOE
AND SENT HIS WORK TO A HEAT TREATING 'PRO'!

HANK KIRKSEY
#8
LIFTED NOW FROM HIS FEVERED BROW
ARE PRODUCTION ACHES AND WEIGHTS.
EXTRA PROFITS LINE HIS POCKETS.
---THAT'S HIM, ON CLOUD NUMBER 8!

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Superficial—for extremely shallow indentations.

Twintester—combines functions of "ROCKWELL" and "ROCKWELL" Superficial testers.

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for perfect testing every time

A perfect diamond penetrator is essential to accurate hardness testing. Since one point of hardness on the "ROCKWELL" scale represents only 80 millionths of an inch of penetration—only 40 millionths on a Superficial tester—the slightest imperfection will cause a false reading.

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A COMPLETE LIBRARY of Helpful Information

A wide variety of bulletins tells about hardness testing, and describes the many instruments, accessories, and services Wilson offers. Write for your choice:

DH-325—WILSON "ROCKWELL" Hardness Testers • **DH-326**—"ROCKWELL" Superficial Hardness Testers • **TT-58**—"ROCKWELL" Twintester • **DH-327**—Special "ROCKWELL" Testers, including Automatic and Semi-Automatic models • **DH-328**—TUKON Tester, for precision MICRO and MACRO testing

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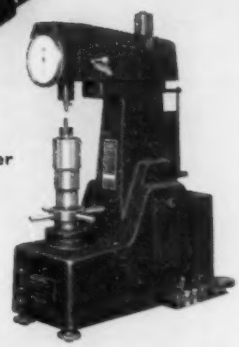
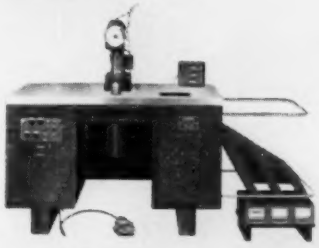


Twintester

Superficial



Automatic

TUKON Tester (for MICRO and MACRO testing)

MANUFACTURERS' LITERATURE

For your copy circle the number on the Readers' Service Card

FLOW RATE METERS

Fischer & Porter Co. has published an illustrated brochure with schematic diagrams and charts describing their flow rate indicating meters for low-cost measurement of gas or liquid flow rates.

For further information circle No. 15

FLAME AND INDUCTION HEATING

The Meta-Dynamics Division of The Cincinnati Milling Machine Co. has published two bulletins which describe with illustrations their equipment for selective precision flame heating and for high frequency induction heating applications.

The one booklet describes equipment for heat processing applications such as spin hardening, spot hardening, tempering, annealing, and brazing which require either high or low heating capacity; and the other brochure describes equipment for high frequency induction heating applications, such as tempering, stress relieving, shrink fitting and annealing.

For further information circle No. 16

GAS-AIR MIXING

A bulletin describing the Waukee Type "R" Mixor for precision gas-air mixing is available from the Waukee Engineering Co. Tables give the various capacities of mixors and the flo-meter selections for endothermic and exothermic generators.

For further information circle No. 17

WIRE CLOTH CATALOGS

A 4-page illustrated bulletin describes the basic products of the Cambridge Wire Cloth Company. Each Cambridge product is fully described in a complete, illustrated catalog and details are given on woven wire conveyor belts, industrial wire cloth, special metal fabrications for heat treating trays, racks and baskets, and on gripper woven wire slings.

For further information circle No. 18

PORTABLE HARDNESS TESTER

A brochure published by Mechanical Devices, Inc., Detroit, Michigan, describes and illustrates their on-the-job precision portable hardness tester that measures surface hardness by incorporating two standard scales corresponding to Rockwell C up to 67 and Brinell 3000-Kg.

For further information circle No. 19

GAS EQUIPMENT CATALOG

A completely new and unique catalog of "BUZZER" industrial gas burners, furnaces and accessories for heat treating, metal melting, soldering and drying has just been issued by Charles A. Hones, Inc., Long Island, N. Y. The new booklet illustrates and describes the full Hones line, including sections on special furnaces and manual and automatic controls. After extensive laboratory and field research in manufactured, natural and liquefied petroleum gas ratings for its equipment, the company has developed highly accurate dimensional and BTU performance tables. Also, to assist in the proper selection of furnaces for their work capacity, Hones has included temperature curve and work rate charts with actual shop tests conducted under actual shop conditions with Strip Chart Recorders. The resulting data furnishes the buyer with a reliable method for pre-determining his heat range and equipment requirements.

For further information circle No. 20

ELECTRIC SALT BATH FURNACES

A bulletin describing and illustrating Upton Salt Bath Furnaces particularly for extrusions and forgings is now available.

For further information circle No. 21

RE-COIL BROCHURE

A 4-page illustrated brochure, describing an innovation for reducing operating costs in industries using high frequency induction heaters, is now available.

The product, trade-named Miller Re-Coil, makes possible the replacement of work coils in a matter of seconds. Adaptable to all makes of induction heaters in use today, the Miller Re-Coil allows the immediate selection of work coils and premits a simple, fast set-up on any job.

For further information circle No. 22

HEATING ELEMENT ALLOY

Metallurgical data and design information on Chromel-A, an 80-20 nickel-chromium resistance alloy, widely used as heating elements in furnaces, industrial heating equipment, ranges and other high temperature electrical heating applications, are included in a new combination catalog and manual announced by Hoskins Mfg. Co.

For further information circle No. 23

FLAME HARDENING

The Detroit Flame Hardening Company has just completed their new catalog on flame hardened rolls. An engineering chart with ranges for hardness and depth usually required in rolls is shown.

Rolls up to 60,000 lbs.—33' in length and 54" in diameter, or for that matter any roll that can be shipped over the highway or on a freight car can be readily flame hardened by the company.

For further information circle No. 24

(Continued on page 47)

(*Continued from page 7*)

best when discharged in a sweeping motion near the fuel surface. A high rate of discharge in any extinguisher enhances its effectiveness.

Incidentally, it is not necessary to remove *all* oxygen from the surrounding atmosphere in order to choke off a blaze. Fire won't burn if the volume of oxygen is dropped to 12 or 15 per cent. And there are several agents besides water that will accomplish this. Sand, or a combination of soda-and-sawdust, will shut off oxygen. These are unlikely to prove as suitable as carbon dioxide (CO_2), an inert gas which dilutes the air, or foam. Carbon dioxide is used indoors; foam is employed mostly outdoors. There also are vaporizing liquids and dry chemicals. For flash fires, a dry chemical extinguisher energized by nitrogen may prove suitable.

Each extinguishing agent has its points.

CO_2 is apparently the only smothering agent that will not contaminate the oil. Compounded quenching oils are more likely to be made unfit for further use by extinguishing agents than are the straight mineral oils.

However, from an unbiased source comes a reminder that carbon dioxide is a *gas*. Hence, there have been instances where the supply was exhausted and the gas dissipated into the air before the temperature of the oil was low enough to be safe. There was a *re-flash*. A second fire took place, and no means were left to check it.

Foam is rather messy, and slower in action; but it stays put, holding the fire under control. A clean-up job can be done later with a hose and plain water. The big oil refineries all seem to prefer foam.

If it is worth the trouble, contaminated oil can be reclaimed thus:

1. Cool the oil thoroughly. Wait 12 to 24 hours for the oil and water to separate.
2. Pump out water.
3. Heat the remaining oil to 180 - 190 F, and blow compressed air through it for 10 or 12 hours.

Planned Protection

Safeguards range all the way from small portable extinguishers hanging on the wall to very elaborate automatic systems. For spill fires, or very small tanks, a small hose with a spray of most any suitable agent may serve. There also are wheeled units that provide both water and a dry chemical supply, complete with a hose and nozzles, ladder, sand pails, axes, wrecking bars and so forth, acting as sort of one-man fire department designed to reach any part of a plant in a hurry.

These are fine so far as they go. Trouble is, they may not reach all points quickly enough. Heat treaters who have been through the mill tell pretty much this

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For HIGH TEMPERATURE APPLICATIONS

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Molten Aluminum PROCESS

CAN PROTECT HEAT TREATING EQUIPMENT FROM CORROSION & HEAT OXIDATION!

The new, ALUMICOAT molten aluminum Process has been perfected to give steels added resistance to corrosion and heat oxidation where continuous high temperatures are a problem.

In the ALUMICOAT Process, heat treating fixtures, trays, etc, are dipped in molten aluminum to produce a metallurgical iron-aluminum bond at the interface and a surface overlay of pure aluminum. At temperatures exceeding the melting point of aluminum, the aluminum on the surface diffuses. This diffused coating, together with the iron-aluminum bond, provides a refractory material that gives steel maximum protection against high temperature scaling.

The ALUMICOAT Process can give you greater economies through the use of lighter yet more rugged fixtures with a longer life through added resistance to corrosion and heat oxidation!

Send for full details. Your inquiry is invited.

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- Capacity for holding shape
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WIRETEX designed MUFFLES offer exceptional opportunities to lower costs. Built to take extremely high temperatures and strong atmospheric conditions. If you have a sintering furnace problem or are dissatisfied with the results you are now getting, let us help you.

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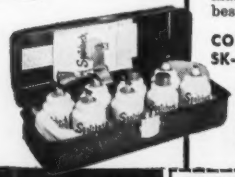

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same story: one moment work was proceeding normally; seconds later the whole place was a roaring mass of flames, and workers were forced to flee for their lives. Picture, if you will, the hopelessness of trying to get near enough to the base of the fire with a small hand extinguisher, or finding time to bring up a tiny fire truck from some distance away!

The modern trend is definitely toward fixed water sprays, and either foam or carbon dioxide systems, which are always ready and wholly automatic. Such sprays are a "must" for any tank exceeding 40 square feet in surface area; and there should be automatic sprinklers under hoods over tanks that exceed 10 square feet of surface.

Some firms have installed permanent CO_2 piping around their oil quench tanks which can be triggered by a quick-acting remote control valve. (See illustration.) However, a less expensive installation consists of a group of carbon dioxide cylinders with 15 or 20 feet of hose connection—very useful in getting close enough to blanket the flames by other means.

On his larger tanks, where the work is mechanically quenched, one owner has metal hoods that lower automatically with the charge, thus smothering any flames. He also keeps handy a wire cutter and an asbestos apron, so if the hoist sticks while a job is part-way submerged, the wire cable can be cut and the whole thing allowed to drop into the tank.

Cooling the oil can avoid fires, or bring them to a halt if they do occur.

Many individual oil quench tanks nowadays are cooled by circulating cold water in submerged coils; primarily to assure more uniform hardness or by a separate heat-exchanger system through which the oil is pumped. It's important that nozzles which return the oil don't spray it into the air. Temperatures are often automatically controlled.

One can add to the temperature control an audible signal that will sound off should the oil exceed the regular operating temperature.

At least two commercial heat treating plants have adopted "air-induction" systems. That is, in their oil tanks are tubes through which cold air can be forced into overheated oil. The lower portion of the oil being thus cooled, this pulls the fire downward until the danger is past.

An ounce of prevention isn't enough.

It is extremely unwise, though it often is the case, to safeguard an oil quench tank and omit some of its auxiliary equipment. A million-dollar fire happened because someone forgot to protect the conveyor which was used to bring up parts out of the quench. All chutes, hoists, conveyors, handling devices, ducts, canopies, drain-boards and the like should have equal protection because to the extent that they become oily, they are involved in your risks.

The Home Brigade

How about organizing your own fire fighting crew?

Since the protection of life and property is a joint responsibility of management and workers, there usually is no difficulty in selecting at least one man for each department—and each shift—and training him. If fire drills are held, other employes also pick up some know-how as time goes on. And of course a watchman should be on hand whenever furnaces are allowed to run while the plant is otherwise shut down.

However, men never can be as dependable as an automatic device. Men are sometimes absent. Occasionally they panic in a pinch, and fail to use their heads. Moreover, the value of any extinguisher will hinge upon how quickly, and how close to the fire, it can be operated. In these respects it's hard to beat a well-engineered fixed and automatic system.

Your fire insurance agent can steer you to competent engineers who in turn will explain how to foolproof your entire plant. Their recommendations will be based on the areas and nature of operations in each department.

They will prepare you for the worst, and make your place of business truly safe.

They will put their plans on paper and submit them to either the Factory Insurance Association if your insurance is in a stock company, or to the Factory Mutual Liability Insurance Co. if you are insured by a mutual. Either must approve such installations before they are made; and this is definitely to your advantage, since approval usually means a rate reduction.

You also can get help and advice from makers of fire-fighting apparatus, or from the National Fire Protection Association, Boston 10, Mass., a non-profit and educational organization which since 1896 has been helping to save life and property.

Equip for 100% protection—nothing less will do.

Provide fire walls (and doors) for larger departments. Provide oil quench tanks of ample capacity, and under them a watertight curbed and drained area. Also a trapped overflow drain to each closed tank, where the oil can be confined. If an unloading chute is used, keep the oil level above the bottom opening of the chute whenever the furnace is hot.

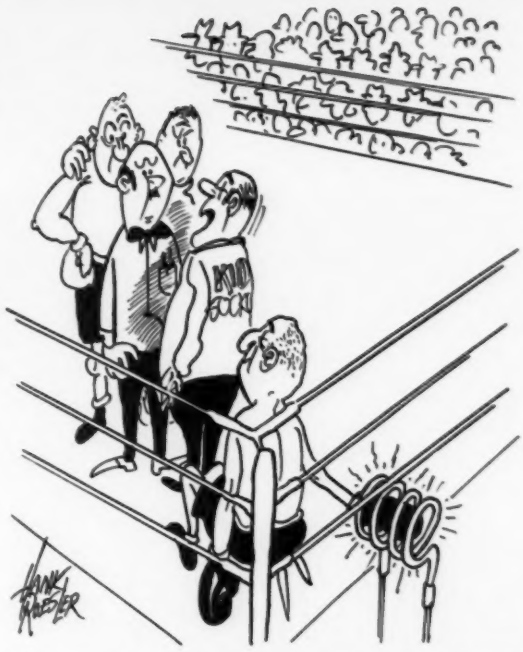
And once you have the equipment—maintain it.

Then when those visiting fireman come for a look-see, you can walk them through your entire plant with a feeling of comfort and justifiable pride. • • •

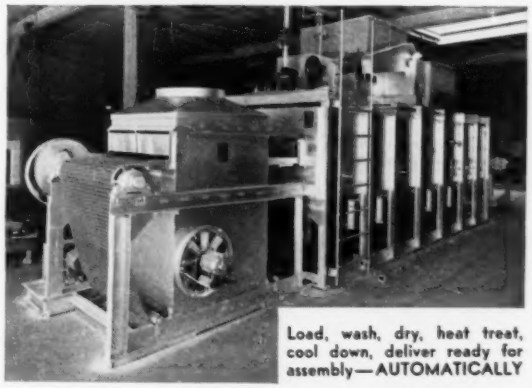
Old Aesop Notwithstanding

There are quite a few common sayings in the business world that are both misleading and unwise in their implications. "If you want a thing well done, do it yourself," is an example. The man who thinks and talks like that is likely to be so tied up in minor details that he will have no time to manage.

—Efficiency Magazine



"SHOW ME IN THE RULES, ANYTHING AGAINST LOCALIZED HARDENING!"



Load, wash, dry, heat treat, cool down, deliver ready for assembly—AUTOMATICALLY

LOOK! NO HANDS!

Once every hour the pyrometer man checks this completely automatic SFE unit — other than that, *no hands!* You can't beat this SFE way of cutting down heat-treat costs, increasing production, bettering the quality of your product.

SFE UNIFORMITY
Every part — regardless of shape, weight or size—gets uniform heat treatment

SFE AUTOMATIC
You don't need 5 college graduates to run this equipment—and keep it running

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Air, gas, pyrometer, belt, recirculating fan and drive — all on complete safety

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Sounds expensive, but bet it costs 20-30% less than you think. Why *not find out?*

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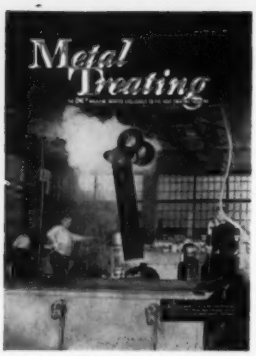
The only magazine devoted exclusively to the Heat Treating Industry



If you sell

Heat Treating Equipment and Supplies

here are 4 basic reasons why

METAL TREATING *should*

be on your advertising schedule:

1. EDITORIAL CONTENT: All editorial effort is directed to the publication of the latest information on methods, techniques, new equipment and materials for the heat treating of metals and other related processes.

It is the quality of the editorial content which turns recipients into readers, and what you want to buy is readers.

2. READERSHIP: Editorial content strictly limited to audience interest and properly balanced with advertising content establishes reader acceptance. This is proved by the return of thousands of Readers' Service inquiry cards.

From the last 12 issues over 6,000 inquiries were received, making an average of over 500 inquiries per issue, or 15 per cent of the average circulation receiving these issues. *In addition over 300 "Letters to the Editor" constantly assure us of reader interest.*

3. CIRCULATION DATA: The controlled and BPA audited circulation reaches nearly 8,000 people — the important personnel who are engaged in some phase of heat treating either in heat treating departments of manufacturing plants or in commercial heat treating plants — all of whom buy your products.

The thoroughness and effectiveness of the coverage is evidenced by the fact that there are only slightly more than 6,000 plants employing more than 20, including commercial heat treaters, engaged in heat treating operations in the entire United States. *You do not pay for excess circulation.*

4. COSTS: An entire year's campaign (6 issues) of a one-page ad in color ($1,920.00) costs much less than fewer insertions in the majority of all other metalworking trade magazines.

Various reader surveys conducted by our advertisers themselves reveal that METAL TREATING is the lowest in cost per page per reader and ranks within the first five of trade journals read and preferred by the recipients of the questionnaires.

Write for our rate card and BPA Audit Report

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Member of Business Publications Audit of Circulation Inc.

Everybody profits ...because **you belong** *in this picture!*

The publisher of this magazine is often asked what kind of a man you are . . . and how many like you are receiving his magazine.

Why is he asked?

Because the *advertisers* (whose money is his chief income) insist upon knowing the types of people (by industry or profession, by title) for whom the magazine is edited — and how many are getting it.

In order to standardize on the presentation of such information to advertisers and to have its accuracy vouched for by a disinterested third party, nearly 450 publishers have joined some 200 leading advertisers and advertising agencies in a non-profit organization called Business Publications Audit.

The purpose of BPA is to assure advertisers . . . by frequently checking and rechecking . . . that each member publisher is indeed distributing his magazine, in the *numbers* promised, to the *types* of men he promised would receive it.

The BPA symbol in this magazine means that *you belong* . . . that because of your occupational interests you are qualified, in the eyes of the advertisers, to receive it.

The advertiser can thus tell whether he's getting his money's worth.

The publisher has a better sales story to prospective advertisers because his magazine is "audited."

And you, the reader, get more value from the magazine because both the advertisers and editors, knowing what your special occupation is and what your interests are, are better able to prepare advertising and editorial material that will be most informative and useful to you.

What you can do

Publishers and advertisers frequently write to magazine readers to learn what kind of articles and advertisements appeal most. Cooperate with them — will you? — by answering their questions . . . in the interest of better communications between makers and markets.

BUSINESS PUBLICATIONS AUDIT OF CIRCULATION, INC.

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BPA

A NON-PROFIT, TRIPARTITE MEMBERSHIP CORPORATION OF ADVERTISERS, ADVERTISING AGENCIES AND BUSINESS PUBLICATIONS

M.T.I. ACTIVITIES

(Continued from page 18)

Fred Heinzelman, Jr. (center) presiding over the Forum at the Spring Meeting of the MTI on "Cost Savings of the Year" and discussing some of the problems with Robert Fish (left) and Arlo E. Leidig (right), both members from California.

MTI Member Has Exhibit at Tool Show

Pictured here is the exhibit booth of the Metlab Co. at the recent ASTE Tool Show held in Philadelphia. Shown are (left to right): George W. Keller, Vice President, Public Relations; Horace C. Knerr, President; Keith A. Hill, Research Engineer, Besly-Wettes Co.; "Mermi of Metlab" (Miss Colleen O'Grady); and Mrs. Margaret Clark, Laboratory Technician.

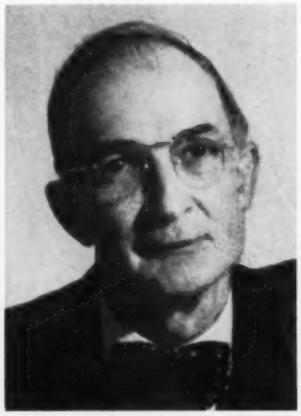
MEMBER HONORED

Fred Heinzelman, Jr. of Fred Heinzelman & Sons, New York City, was honored recently by being invited to join the Polytechnic Institute of Brooklyn Chapter of Pi Tau Sigma, the national honorary mechanical engineering fraternity.

To commemorate the Tenth Anniversary of the founding of the Chapter at the Polytechnic Institute ten prominent alumni of the Institute were invited to membership in Pi Tau Sigma and Fred Heinzelman, Jr. was one of those invited.

Initiation ceremonies were held on Saturday morning, May 10th, followed by a dinner at the Hotel Bossert.

George E. Lorenz



It is with deep regret that we announce the death of member George E. Lorenz, Founder and President of Lorenz & Son, steel hardening firm in Philadelphia, Pennsylvania. He passed away on Monday, March 17, 1958, at Jeanes Hospital. He was seventy-five years of age and resided at 431 Tyson Street, Philadelphia. Mr. Lorenz founded the firm twenty-nine years ago. Surviving are his wife, Catherine S. and two sons, George S. and Carl E., who will continue to run the business at the same address.

MANUFACTURERS' LITERATURE

(Continued from page 40)

HEAT RESISTING ALLOYS
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Stock List and Literature Available
ROLLED ALLOYS, INC.
Heat and Corrosion Resistant Alloy Specialists
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For further information circle No. 25

HEAT TREATING ARTICLES

New issue of "Heat Treat Review" features story on production heat treating of gears and parts in continuous gas carburizer with controlled atmosphere equipment is now available from Surface Combustion Corp. Other articles describe the new application of DX® Gas Generators to condition oil field flood water and a one man heat treat department at a manicuring implement manufacturer's plant.

For further information circle No. 26

HEAT TREATING EQUIPMENT

A profusely illustrated, 12-page bulletin issued by C. I. Hayes, Inc. describes the design advantages and available sizes of this company's line of hardening, pre-heat, high speed steel, tempering, and vertical furnaces. It also describes the Hayes "Certain Curtain" atmosphere and its features, as well as their Endothermic Atmosphere Generators.

For further information circle No. 27

PLATING SOLUTION FILTER

A two-page bulletin which pictures and describes its compact new Dincalux Portable Filter for a wide variety of plating solutions is being offered by the Hanson-Van Winkle-Munning Co. Measuring only 12" in diameter and 28" high, the unit has 3.5 sq. ft. of filtering area and a capacity of 900 GPH free flow and 600 GPH with carbon charge.

For further information circle No. 28

YOUR HEAT TREATING GUIDE FOR PERMANENT MARKINGS

MARKAL "M" PAINTSTIK MARKERS
Easy to use to mark at room temperature. Markings stay visible up to 1600°F. Ideal for all surfaces in any condition.

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Make marks while surface is cold. Marks remain visible up to 2400°F.

FOR: *Surface welding, butt welding, annealing, normalizing, stress relieving, preheating for welding, forging or carburizing.*

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3102 West Carroll Avenue — Chicago 12, Illinois

Jelliff
heat-treating
baskets
•
All shapes, sizes, alloys. Estimates without obligation.

THE C. O.
JELLIFF
MANUFACTURING CORP.
SOUTHPORT • CONNECTICUT

Ask for Catalog D

(Continued from page 12)

that before an employee can be coerced into a secondary boycott he must be "in the course of his employment." If the union official refuses to send men to a job, they are not yet in the course of their employment—thus no illegal boycott.

Is Burt the victim of a private union feud between the Steelworkers and the Sheetmetal workers unions?

No, it's anything but private; other employers and other unions are caught in the secondary boycott web. The Carnes Corp. of Verona, Wis., which employs AFL-CIO Machinists, and a Detroit company whose employees belong to the United Auto Workers, have been boycott victims like Burt. The Market Forge Co. of Everett, Mass., which also has a union shop agreement with the Steelworkers union, is another victim.

What is the secondary picketing loophole?

For the secondary picketing loophole the experience of the Barry Controls Co. of Watertown, Mass., offers a good example. When the steelworker officials, who represent Barry's employees, called a strike they used carloads of pickets to follow Barry's trucks on deliveries to freight terminals and the plants of other employers located four or five miles away.

Although the National Labor Relations Board found this technique an illegal secondary boycott, it probably would not have reached this decision if the Barry company did not have a plant in the vicinity that could be picketed.

In general, lawyers tell me that this type of secondary or ambulatory picketing is not prohibited by the present law, unless certain limited legal tests are met. In fact in the Barry case, a federal judge in Boston refused to issue an injunction. He contended there was no "commanding authority" that Taft-Hartley had been violated.

The chief objection, however, is that regardless of the limited tests to outlaw this type of secondary picketing, innocent neutrals are being involved in labor problems that do not concern them.

Relief for neutrals is the chief aim of the Curtis-Smith bill.

What is this hot cargo clause that you listed among the primary loopholes?

This is a standard clause the Teamsters and other unions seek to insert in collective bargaining contracts. It provides that the union and its members reserve the right to refuse to accept or handle goods from struck plants or even plants the Teamsters are trying to organize. It also adds that if an employer orders his employees to handle these goods, the union has the right to call an immediate strike against him.

This technique is used all over the country, but since 1955 the Labor Board has held that such contracts cannot be used as a secondary boycott defense. The Board's decision, although affirmed by the U. S. Court of Appeals in San Francisco, was rejected by the Court of Appeals in the District of Columbia. The matter probably will reach the Supreme Court for final settlement. The passage of the Curtis-Smith bill would outlaw hot cargo contracts, and there would be no need to depend on the changing interpretations of the Labor Board and the courts.

How about a practical example of how hot cargo works?

Well, I said it is used all over the country. In Portland, Maine, the Teamsters were trying to organize the Maine Canned Foods Co., but in an official election among employees the union lost. That didn't stop the business agent. He advised that there was more than one way to skin a cat. The union threw a picket line around Maine's plant; picketed the Monmouth Canning Co. because it owned 50 per cent of Maine; and reminded the unionized trucking companies in the area that hot cargo agreements were being invoked.

In Nebraska where the Teamsters have had a continual drive on organizing small truck lines, the Dutton-Lainson Co. of Hastings found it was taking a week or more to get delivery on their goods which normally could be delivered in a day. The Nebraska situation became so serious that it alarmed Senator Curtis; thus, the bill to outlaw permanently all secondary boycotts.

But the hot cargo boycotts that generated the most heat came out of Texas and California. When the Teamsters tried to compel the employees of the Galveston Truck Lines of Houston to join their union, they used the hot cargo technique, but it backfired!

Desmond Barry, Galveston's president, immediately filed three actions—an NLRB charge against the union; an antitrust suit against truck lines who went along with the union's hot cargo demand; and a petition to the Intersate Commerce Commission asking that hot cargo be declared illegal and that the certificates of convenience and necessity of the union-cooperating carriers be revoked. The Teamsters backed down, but fast!

The other classic was the attempt by the Carpenters union in Los Angeles to use hot cargo to compel the employees of the Paine Lumber Company, 2,000 miles away in Oshkosh, Wis., to join their union. It was this case that resulted in the new Board view and which may reach the Supreme Court.

Let's get back to S. 76 and H.R. 9307 Is there opposition to them?

Union officials, of course, strongly oppose such a curtailment of their power. A study of the union movement shows that the secondary boycott has been a traditional weapon to achieve compulsory unionism or win labor disputes that can't be won by fair methods.

What about the other side of the picture? Are there bills in Congress to further weaken present secondary boycott prohibitions?

Yes, there are a number pending before the labor committees of both the Senate and House. They range from giving certain unions special or unlimited secondary boycott power to repealing the Taft-Hartley Act completely and returning to the one-sided, pro-union Wagner Act. As you know, the Wagner Act had no unfair labor practices for unions; a union boss could do no wrong.

Will support of the Curtis-Smith bill come along party lines?

No, it shouldn't. Secondary boycotts are not Republican or Democrat. They are an evil that raise costs and remove from the public the freedom to do business with anyone they please. Boycott legislation is nothing more than the correction of a public abuse. As Senator Curtis has said, they are the unions' most vicious practice except for violence.

What chance does S. 76 or H.R. 9307 have for passage?

Enactment depends upon the constituents back home. It is up to the grass roots to interest their congressmen in putting an end to secondary boycotts, but there will be tremendous opposition from the labor bosses.

What can these so-called grass root groups do?

It's easy to advise what to do, but the actual doing is anything but easy. First, if a businessman belongs to a trade association or a chamber of commerce, he should get that organization to establish a secondary boycott committe or subcommittee and begin to publicize injustice to local victims. These cases can be called to the attention of state and federal legislators. Of course, bills like S. 76 should be offered and supported.

Is there a place interested businessmen or local associations can go for secondary boycott information?

Yes, our own Secondary Boycott Committee of the U. S. Chamber of Commerce in Washington, D. C., can supply this information. As Chairman of this special committee, I know that the Chamber has publications available for distribution to aid boycott victims. They also can contact their local chamber and ask them to get in touch with our Boycott Committee.

Our Committee also maintains a speaker's list and can provide business specialists to discuss secondary boycotts to chamber, association, or convention groups. I hope that the readers of this piece will try to help us combat all secondary boycotts no matter where they occur or whom they affect. • • •

The Metal Treating Institute

Annual Achievement Award

The award is made at the discretion of a Committee appointed to select the Best Article appearing in METAL TREATING magazine or Lecture presented at any meeting of the Institute.

This year's award shall be presented at the 1958 Annual Meeting of the Institute, and all Articles appearing in any issue of METAL TREATING from September-October 1957 to July-August 1958 or any Lectures presented at the 1957 Annual and 1958 Spring Meetings are eligible for consideration.

AWARD COMMITTEE—

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Members, Publication Committee

C. E. Herington, *Editor, METAL TREATING*

LETTERS TO THE EDITOR

Gentlemen:

While visiting at the Rockwell Spring and Axle Company, Timken-Detroit Axle Division in Detroit, Michigan, I read a copy of your magazine "METAL TREATING" and have found it to be of great interest.

I am wondering if I could be put on your mailing list for this booklet as I believe that it will be of great value to me in India. Thank you kindly!

D. M. Davar
Metallurgical Engineer
Premier Automobile, Ltd.
Bombay, India

Dear Editor:

Thank you for sending me the July-August issue of METAL TREATING containing an announcement of the new course offered by Wentworth Institute in Metals Technology.

We have received many inquiries concerning this course, as a result of your article, and the cards which you have sent to us, and we are grateful to you for rendering us this service.

H. Russell Beatty, President
Wentworth Institute
Boston, Mass.

Gentlemen:

We find your magazine "METAL TREATING" a valuable source of information and we would appreciate having our metallurgist, Mr. T. E. Miller, added to your mailing list.

Ross Williams, Superintendent
East Texas Steel Castings Company, Inc.
Longview, Texas

Dear Sirs:

I have recently seen several issues of your publication, "METAL TREATING", and found them to be extremely interesting. I would appreciate it very much if you would place my name on your distribution list so that I may receive future issues.

J. S. Hopkins,
Metallurgical Control Section
Aviation Gas Turbine Division
Westinghouse Electric Corp.
Kansas City, Mo.

Dear Sirs:

Your magazine "METAL TREATING" was recommended to me by the manager of our heat treating department. And after having read several copies of it I have found it to be of great value to me in my work as a Tool Hardener in the heat treat department.

I would appreciate it if my name could be put on your mailing list.

Joseph C. Dolan,
Tool Hardener
International Business Machines Corporation
Poughkeepsie, New York

Gentlemen:

On several occasions I have had the opportunity of reading your publication "Metal Treating". I have found the articles of considerable interest and applicable to the investigational effort of our Engineering Branch which is a part of the Technical Shops Division of Naval Ordnance Laboratory.

N. P. Sarelas, Co-Chief
Technical Shops Division
U. S. Naval Ordnance Lab.
Silver Spring, Md.

Gentlemen:

Please advise the subscription rate to your publication "METAL TREATING".

If receipt of the publication is contingent upon membership in the Metal Treating Institute, please advise what the requirements are for becoming a member of the Metal Treating Institute.

E. S. Freshwater
General Electric Company
Apparatus Sales Division
Detroit, Mich.

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METAL & THERMIT CORPORATION

GENERAL OFFICES: RAHWAY, NEW JERSEY

CARBURIZING COMPOUND

(Continued from page 10)

and reclaimed material when it falls into the truck. A vent pipe in the top of each storage hopper connects into a fan located on top of the dust booth which provides the suction required for the conveying of the material from the dump hopper to the storage hoppers and also removes the dust from the storage hoppers. This fan discharges the dust laden air into the dust booth duct which in turn carries it into the Multi-Swirl Collector. Thus all air used for conveying and from the dust booth is cleaned and returned into the building. (See Fig. 3)

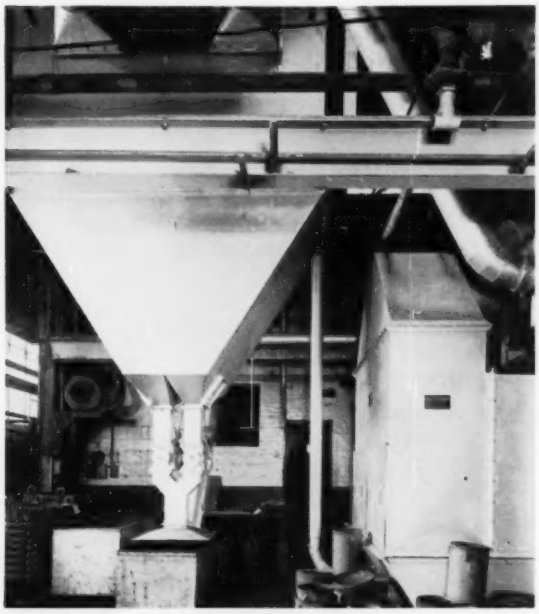


Figure 3

The Multi-Swirl Wet Dust Collector is a three-stage precipitator in which the centrifugal, water curtain and scrubbing principles are used without resorting to mechanical devices. The first or centrifugal stage is created when the air strikes the water through a specifically designed inlet and is thrown against a curved sheet. This first stage removes the heavier dust particles. The second or water curtain stage is when the air passes through the water falling from the third stage cylinders. The third or scrubbing stage is created by the meeting of the high velocity air with the falling water around two cylindrical tubes, causing tremendous turbulence and scrubbing action with a resulting high precipitating efficiency.

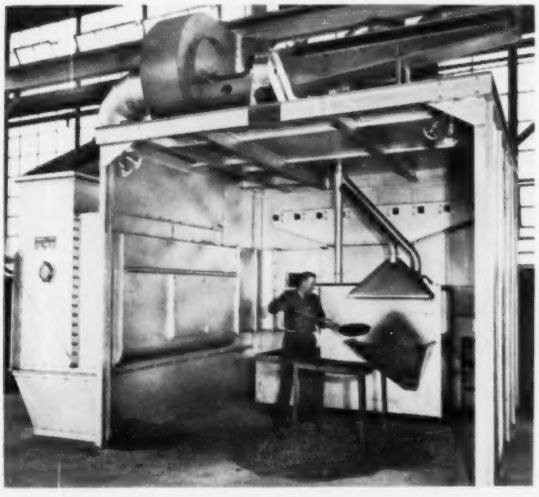


Figure 4

This complete unit occupies a space inside of the building 33′-3″ wide x 14′-0″ deep x 23′-3″ high. The complete unit was built and installed by H. M. White, Inc., Detroit, Michigan.

A similar dust booth without the storage hoppers has been in operation at Commercial Steel Treating Corporation's Plant No. 2 for over one year with highly satisfactory results. (See Fig. 4) • • •

Sound Familiar?
AROUND THE HOUSE OLD SAM PELF IS A GREAT BELIEVER IN "DO-IT-YOURSELF."
PLUMBER, PAINTER & CARPENTER BILLS AREN'T GOING TO PESTER ME! I'LL FIX THINGS MYSELF! THINK OF ALL THE MONEY WE'LL SAVE TO BUY...
..ME THAT MINK COAT WITH!
...BUT AT HIS SHOP HE FOUND IT DIDN'T PAY TO HEAT TREAT PARTS THE "HOME-WORKSHOP" WAY!
BUT WHERE ARE ALL THOSE EXTRA PROFITS I PLANNED ON FROM SETTING UP OUR OWN "DO-IT-OURSELVES" HEAT TREATING DEPARTMENT?
YOU'RE LOOKING AT THE WRONG SIDE OF THE LEDGER, MR. PELF.
EQUIP. COSTS & DEPRECIATION
MAINTENANCE
EXTRA FLOOR SPACE
MAINTAINING HEAT IN BETWEEN JOBS
LABOR
INSURANCE-ETC

THE USE OF ELECTRICITY

(Continued from page 5)

too numerous to mention, but I would like to point out the salient features relative to the economies on a couple of selected jobs.

For instance, in the case of the steering knuckles, we were using an alloy steel. The alloy forging was heated, quenched, and drawn to a hardness of 255-321 Brinell. The steering knuckles were then machined, ground, and finished. Today we are using a plain carbon steel, AISI-1046, and normalizing the forgings to a hardness of 229-268 Brinell. The knuckles are then rough machined after which the critical fillet areas are induction hardened and tempered to a hardness of 42-47 Rockwell C. The parts are then ground and finished. By the outlined changes we have improved machinability, greatly increased the fatigue strength of the knuckles by using a higher hardness in the critically stressed areas, and have in the complete change wound up with a substantial cost savings per part. The savings is accounted for principally in the difference between the cost of plain carbon steel and the cost of alloy steel formerly used. Similar savings were involved in changing materials on rear axle drive shafts allowing for the use of induction case hardened AISI-C1037 steel shafts instead of the through hardened alloy steel shafts formerly used. We see a great future in this type of thinking where we can use a less-costly material to perform a function, and with the help of induction hardening actually achieve superior physical properties with a savings in product cost.

There is another quite unique application we have found for induction heating. The drive pinions in automotive rear end sets are carburized and quench hardened to Rockwell C 58 minimum. This gives the drive ring gear the necessary hardness to withstand wear from millions of revolutions. However, the thread end of the pinion, which attaches to the drive shaft, is subjected to severe torque and must be drawn back to a tough structure to prevent brittle failure. This used to be accomplished in lead pots by immersing the thread end in molten lead and gave a nice sharp line of demarcation between the tough threads and the areas required to be very hard. However, lead pots are messy and hot to operate and if the lead is even the least bit dirty it sticks to the steel immersed in it. This required wire brushing to remove the lead, and wire brushing is expensive. While we were experimenting with induction we thought about this tempering problem a great deal and finally built up an induction tempering unit powered by a 560 cycle motor generator set. The power rating and frequency were so selected that a maximum temperature of 1200°F could not be exceeded and hence the time factor was eliminated from the cycle. This low frequency induction unit solved the problem completely.

We have also used low frequency, 60-cycle power

in this case, to expand flywheel ring gears to enable assembly to the flywheel. Sixty-cycle power is very satisfactory for applications such as this and is readily obtainable from a used welding transformer, which most plants have available.

Induction Melting

Let us look for a moment at an entirely unrelated application of electrical heating. Some years ago we decided, in view of the existing tight aluminum market, that we would have to control our aluminum alloy scrap in order to keep our piston foundry in operation. At the time, we were generating approximately 20,000 pounds per day of aluminum scrap in the form of turnings from castings we were machining. We decided to install facilities to reclaim this scrap and cast it in the form of refined ingot for use in our foundry. After studying all the possibilities, low frequency, 60-cycle induction melting equipment was selected to melt the aluminum chips. This furnace facility has been in continuous operation for over nine years with a net melt loss that has consistently been between four and six per cent. I know of no gas-fired equipment that can come close to approaching such a remarkable figure.

The secret of such a low melt loss in the induction furnaces seems to be in the inherent stirring action present. Chips are fed in at a controlled rate by means of electrical vibrating feeders. The rate of chip feed is controlled to be identical with the melting rate of the furnace, which, with its moderate bubbling action, melts the chips as soon as they contact the bubbling metal. Hence the chips cannot stand on top of a hot bath of molten metal and burn up. This I consider to be an outstanding example of the economies involved in selected applications of electrical heating—regardless of the initial unit cost of the electrical energy compared to gas.

We have other melting requirements for which electric furnaces were selected because of their adaptability to the job requirements. Electric arc furnaces are used to melt metal for cast iron camshafts. In another foundry, electric induction furnaces are used to melt alloyed steel for armament castings. Electric furnaces are used to melt highly alloyed ferrous metals in our precision casting foundry.

Conclusion

This article has attempted to present to you briefly some of the things we feel can be done more easily or more inexpensively with electrical energy than by other means. The applications that have been discussed are advantageous to us in locations involving electric power rates of $0.013 per KWH and natural gas at $0.054 per therm. There would be many other possible applications for electrically-heated furnace equipment in an economy of decreased electric rates. With the rapidly approaching possibility of atomic-powered generating facilities, we may well be on the threshold of such an economy. ● ● ●

MODERNIZING?

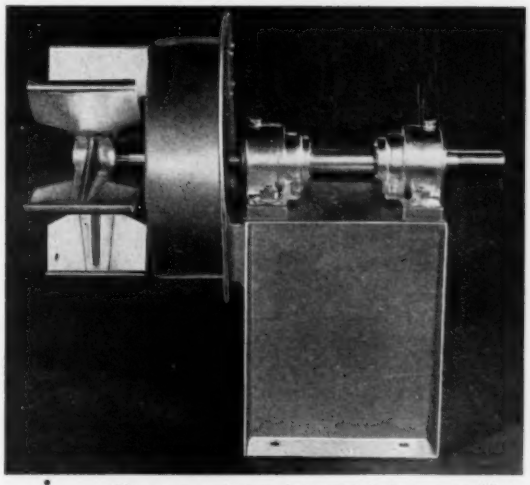
The NEW Radial Blade

PLUG TYPE UNIT BY

GARDEN CITY FAN

(for temperatures up to 1650°)

cuts costs because it eliminates duct work



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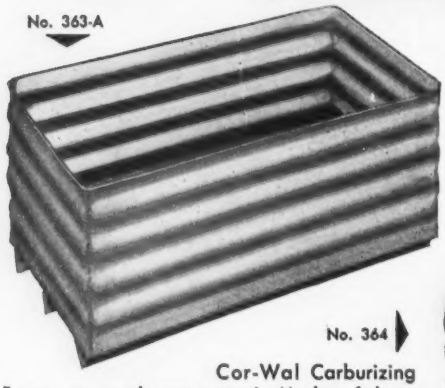

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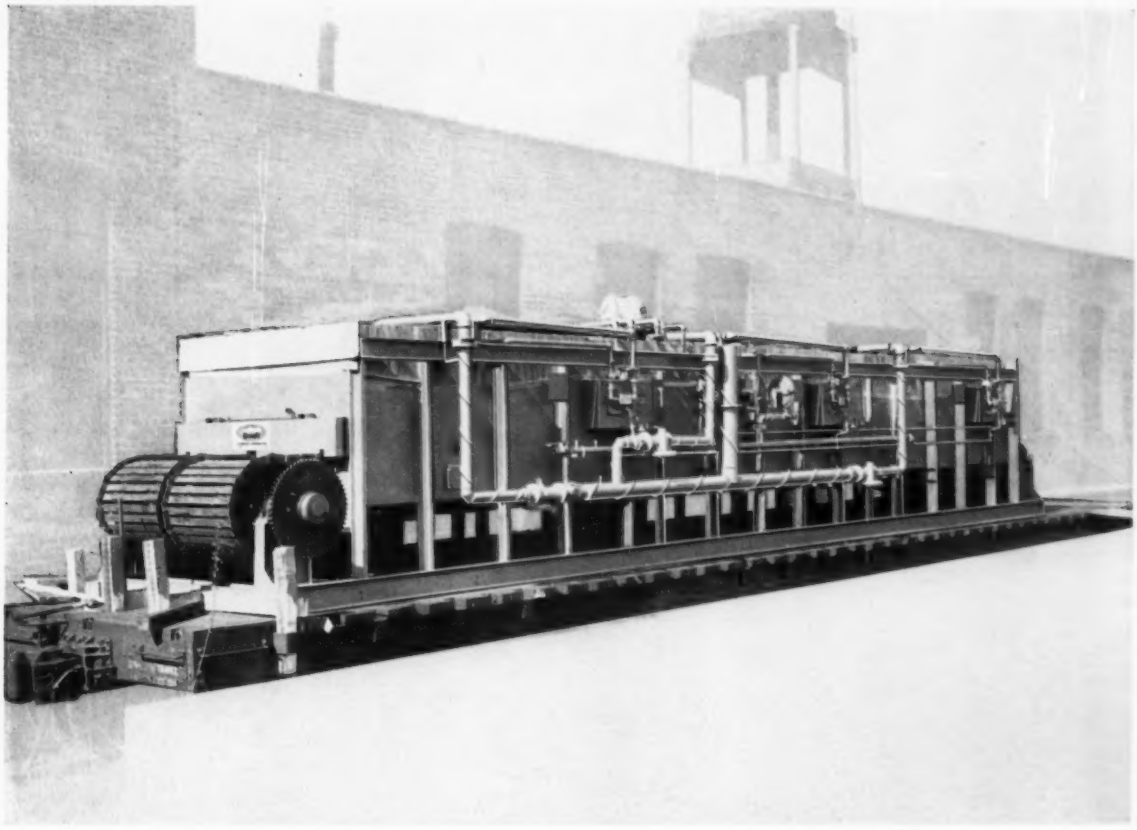

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